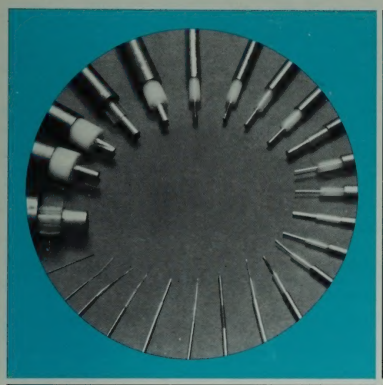

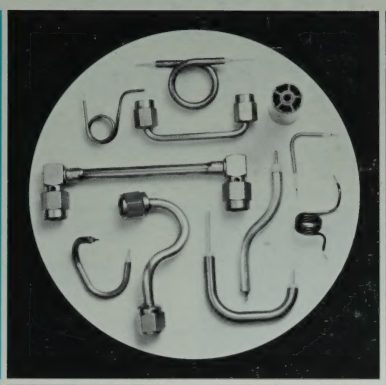

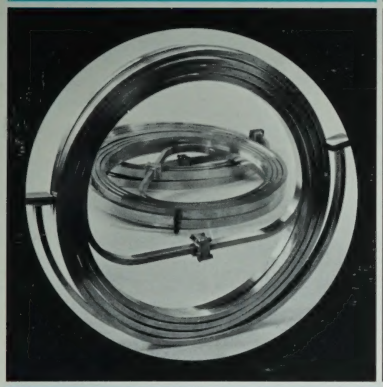

-00001 MICRO-COAX COMPONENTS INC. UT-250A-TF
129-RG401 MICRO-COAX COMPONENTS INC. UT-250A-
M17/130-00001 MICRO-COAX COMPONENTS INC. UT-141-SR-TP-M17
M17/130-RG402 MICRO-COAX COMPONENTS INC. UT-141-SR-M17
M17/133-00001 MICRO-COAX COMPONENTS INC. UT-85-TP-M17
M17/133-RG405 MICRO-COAX COMPONENTS INC. UT-85-M17

MICROWAVE COMPONENTS

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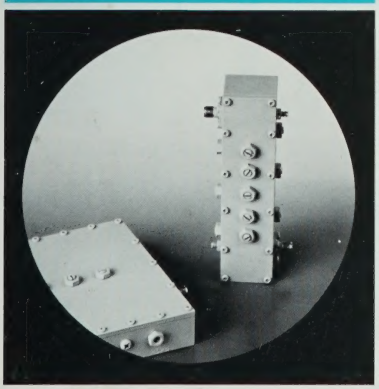

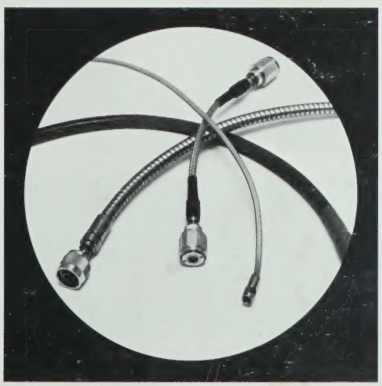

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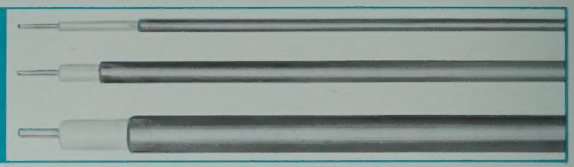

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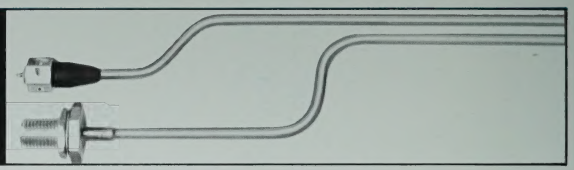

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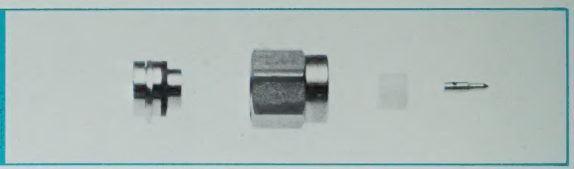

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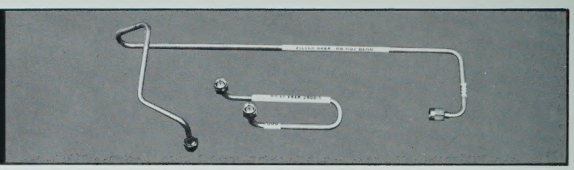

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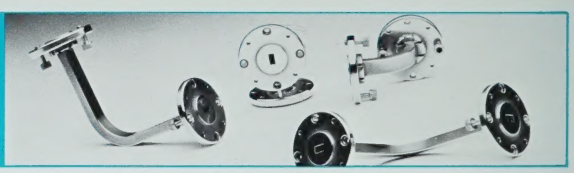

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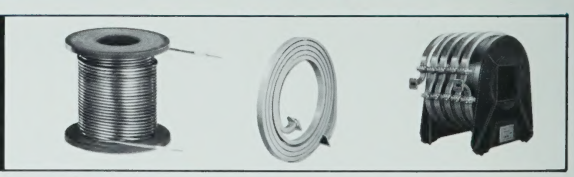

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SECTION I

GENERAL INFORMATION ON MICRO-COAX SEMI-RIGID COAXIAL CABLE

The purpose of Micro-Coax Semi-Rigid Coaxial Cable is to transmit and/or receive a high-speed, high-frequency microwave signal. It is the most practical and beneficial method for achieving:

- low loss, total shielding at or near theoretical value
- elimination of radiation leakage
- lowest possible attenuation
- unequalled SWR performance above 12 GHz
- miniaturization of power componentry

With semi-rigid Micro-Coax Cable, a high frequency signal can be delivered with maximum power handling efficiency and minimum interference in a very small configuration. Where great distances are involved, it is impractical because of cost to string a semi-rigid coaxial line. In this case, an interconnection is used between semi-rigid and flexible cables.

The outstanding performance characteristics of Micro-Coax Semi-Rigid Coaxial Cable include:

- Workability: It is easily bent, coiled, stripped, machined, soldered, or connected without impairing performance. Ends can be rapidly and reliably prepared.
- Attenuation: A solid center conductor provides the optimum geometrical surface for transmission.
- Impedance Matching: Low SWR. The dielectric is controlled to exacting tolerances, thus minimizing reflected power loss.
- Shielding: Isolation greater than 130 dB. Virtually no extraneous signal pick-up.
- Packaging: Metallic tubular outer conductor offers minimum size and maximum outer conductor integrity. Copper jackets can be soldered directly to circuit boards.

TYPICAL APPLICATIONS FOR MICRO-COAX SEMI-RIGID COAXIAL CABLE

Semi-rigid coaxial cable finds application in frequency ranges from 500 megahertz (500 MHz) through 40 gigahertz (40.0 GHz) and beyond.

Almost any system designed for 500 megahertz and above, and in need of good operational performance and total shielding, can utilize semi-rigid coax. Semi-rigid lines and fabricated assemblies are used in high-speed computer systems, medical electronics, communications systems, and nuclear power plants. In componentry, semi-rigid coax is used in oscillators and amplifiers, printed circuit boards, delay lines, and capacitor sections.

Micro-Coax is also used in CATV transmission systems where it helps to eliminate crosstalk, resulting in better reception with less interference.

DESIGN CONSIDERATIONS FOR MICRO-COAX CABLE COMPONENTS

Micro-Coax Semi-Rigid Coaxial Cable is an assembly of three basic parts, namely:

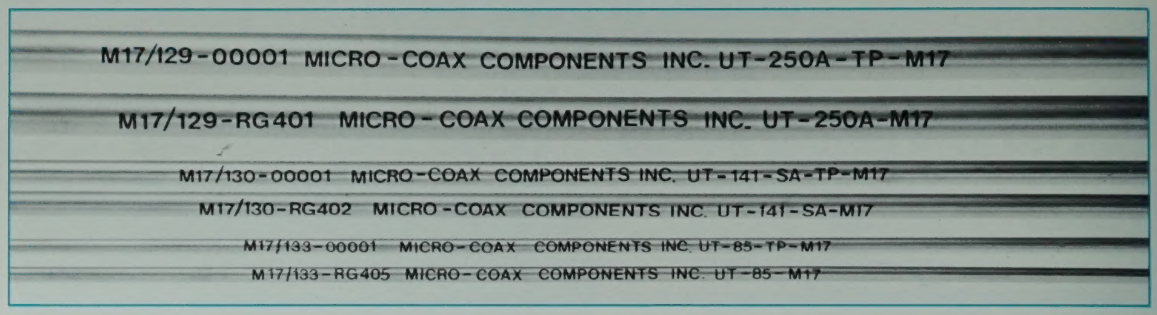
- a seamless tubular metal jacket which serves as an outer conductor
- a dielectric or insulating material
- a metallic center conductor

Each of these parts has options as to material, size, and in most cases, configurations, as will be explained in this section.

Cable components, both conductors and insulation, can be closely controlled to inner and outer diameters, and assembled in such a manner that tolerances are maintained through the entire cable length. This is true even when secondary operations, such as bending or coiling, are involved. Thus, the best practicable performance criteria can be estimated and maintained.

Micro-Coax Semi-Rigid Coaxial Cable showing outer conductor, dielectric, and center conductor.

MIL-SPEC APPROVED MICRO-COAX COAXIAL CABLES


M17/129-00001 MICRO-COAX COMPONENTS INC. UT-250A-TP-M17
M17/129-RG401 MICRO-COAX COMPONENTS INC. UT-250A-M17
M17/130-00001 MICRO-COAX COMPONENTS INC. UT-141-SA-TP-M17
M17/130-RG402 MICRO-COAX COMPONENTS INC. UT-141-SA-M17
M17/133-00001 MICRO-COAX COMPONENTS INC. UT-85-TP-M17
M17/133-RG405 MICRO-COAX COMPONENTS INC. UT-85-M17

MIL-C-17F APPROVAL

Twelve Micro-Coax Semi-Rigid Coaxial Cables, designed and fabricated by the Micro-Coax Components, Inc., have successfully completed qualification and have been approved under MIL-C-17F Qualified Products List (QPL).

HOW MIL-C-17F APPROVAL BENEFITS CUSTOMERS

- Under MIL-C-17F, all Micro-Coax Components M17 qualified cables are inspected for quality and optimum performance prior to being put in stock. This eliminates the need for special purchasing specifications and costly, time consuming "customized" inspections previously required to conform to the customer's group testing requirements of MIL-C-17F.

Tests ensure cable conformance with broadband performance requirements for attenuation and SWR (structural return loss), coaxial concentricity, conductor adherence, dimensional stability and weight.

- Four of the M17 qualified cables are in 0.047" (1.194mm) and 0.034" (0.864mm) OD sizes. These cables are finding increased usage in densely packaged and minimum weight systems such as advanced airborne requirements.
- New "M17" part numbers supersede familiar "RG" part numbers. RG specifications have been deleted by DESC (Defense Electronics Supply Center).
- Cables designated M17/129, 130 and 133 are marked continuously for visual cable identification.
- Outer conductor finishes, other than no plating or tin plating, can be specified for unplated M17 cable.
- Stocks of all M17 cables will be carried at Micro-Coax Components and distributor locations.

MIL-C-17F PRODUCT SPECIFICATIONS

MIL-C-17F Designation	Micro-Coax Part Number	Nominal Impedance (ohms) and Tolerance / ± ohms	Outer Conductor Diameter (inches/mm) ± 0.001" / ± 0.0254mm	PTFE Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Center Conductor Diameter (inches/mm) Nominal	Center Conductor Material	Operating Temperature Range (°C)	Minimum Bend Diameter (inches/mm)
M17/129-RG401	UT†† 250A-M17 ★	50.0/0.5	0.250/6.35	0.209/5.309 (2)	0.0641 1.628 (3)	SPC	-40 to 90	0.75/19.05
M17/129-00001	UT 250A-TP-M17 ★	50.0/0.5	0.250/6.35 (1)	0.209/5.309 (2)	0.0641 1.628 (3)	SPC	-40 to 90	0.75/19.05
M17/130-RG402	UT 141SA-M17 ★	50.0/1.0	0.141/3.58	0.1175/2.985	0.0362 .9195 (4)	SPCW	-40 to 125	0.50/12.7
M17/130-RG402	UT 141-SJ-M17 ★	50.0/1.0	0.141/3.58	0.1175/2.985	0.0362 .9195 (4)	SPCW	-40 to 125	0.50/12.7
M17/130-00001	UT 141SA-TP-M17 ★	50.0/1.0	0.141/3.58 (1)	0.1175/2.985	0.0362 .9195 (4)	SPCW	-40 to 125	0.50/12.7
M17/130-00001	UT 141-SJ-TP-M17 ★	50.0/1.0	0.141/3.58 (1)	0.1175/2.985	0.0362 .9195 (4)	SPCW	-40 to 125	0.50/12.7
M17/130-00002	UT 141SA-Ni-M17	50.0/1.0	0.141/3.58	0.1175/2.985	0.0362 .9195 (4)	SPNiCW	-40 to 125	0.50/12.7
M17/130-00003	UT 141SA-TP-Ni-M17	50.0/1.0	0.141/3.58 (1)	0.1175/2.985	0.0362 .9195 (4)	SPNiCW	-40 to 125	0.50/12.7
M17/133-RG405	UT 85-M17 ★	50.0/1.5	0.0865/2.20	0.066/1.676 (2)	0.0201/0.511 (5)	SPCW	-40 to 125	0.25/6.35
M17/133-RG405	UT 85-SJ-M17 ★	50.0/1.5	0.0865/2.20	0.066/1.676 (2)	0.0201/0.511 (5)	SPCW	-40 to 125	0.25/6.35
M17/133-00001	UT 85-TP-M17 ★	50.0/1.5	0.0865/2.20 (1)	0.066/1.676 (2)	0.0201/0.511 (5)	SPCW	-40 to 125	0.25/6.35
M17/133-00001	UT 85-SJ-TP-M17 ★	50.0/1.5	0.0865/2.20 (1)	0.066/1.676 (2)	0.0201/0.511 (5)	SPCW	-40 to 125	0.25/6.35
M17/133-00002	UT 85C-M17 ★	50.0/1.5	0.0865/2.20	0.066/1.676 (2)	0.0201/0.511 (5)	SPC	-40 to 125	0.25/6.35
M17/133-00003	UT 85C-TP-M17 ★	50.0/1.5	0.0865/2.20 (1)	0.066/1.676 (2)	0.0201/0.511 (5)	SPC	-40 to 125	0.25/6.35
M17/133-00004	UT 85-Ni-M17	50.0/1.5	0.086/2.18	0.066/1.676 (2)	0.0201/0.511 (5)	SPNiCW	-40 to 125	0.25/6.35
M17/133-00005	UT 85-TP-Ni-M17	50.0/1.5	0.086/2.18 (1)	0.066/1.676 (2)	0.0201/0.511 (5)	SPNiCW	-40 to 125	0.25/6.35
M17/151-00001	UT 47-M17 ★	50.0/2.5	0.047/1.19	0.037/0.940	0.0113/0.287 (5)	SPCW	-40 to 100	0.25/6.35
M17/151-00002	UT 47-TP-M17 ★	50.0/2.5	0.047/1.19 (1)	0.037/0.940	0.0113/0.287 (5)	SPCW	-40 to 100	0.25/6.35
M17/154-00001	UT 34-M17 ★	50.0/3.0	0.034/0.86	0.026/0.660	0.008/0.203 (5)	SPCW	-40 to 100	0.25/6.35
M17/154-00002	UT 34-TP-M17 ★	50.0/3.0	0.034/0.86 (1)	0.026/0.660	0.008/0.203 (5)	SPCW	-40 to 100	0.25/6.35

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†† Registered trademark of UTI Corporation

MAXIMUM ATTENUATION and POWER RATINGS

MIL-C-17/129C			MIL-C-17/130C			MIL-C-17/133B			MIL-C-17/151			MIL-C-17/154		
Attenuation (6)		Power (7)	Attenuation (6)		Power (7)	Attenuation (6)		Power (7)	Attenuation (6)		Power (7)	Attenuation (6)		Power (7)
MHz	dB	Watts	MHz	dB	Watts at 1.5 SWR	MHz	dB	Watts	MHz	dB	Watts	MHz	dB	Watts
400	4.5	1900	500	8	600	500	15	180	500	28	45	500	42	14
1000	7.5	1400	1000	12	450	1000	22	130	1000	40	32	1000	60	10
3000	11	750	3000	21	250	5000	50	54	3000	70	18	3000	100	6
10000	33	350	5000	29	180	10000	80	35	5000	90	13	5000	140	4.5
18000	48	200	10000	45	120	20000	130	20	10000	130	9	10000	190	3.1
—	—	—	20000	70	70	—	—	—	20000	190	6.5	20000	280	2

Structural Return Loss		Structural Return Loss		Structural Return Loss		Structural Return Loss		Structural Return Loss	
MHz	dB	MHz	dB	MHz	dB	MHz	dB	MHz	dB
500	26	500	30	500	28	1000	22	500	22
5000	21	5000	23	5000	23	10000	18	5000	21
10000	19	18000	21	20000	15	20000	14	20000	15
18000	16	—	—	—	—	—	—	—	—

(1) Allow additional + 0.001" (0.0254mm) for plating.
(2) Dimensional tolerance is ±0.002" (0.0508mm).
(3) Dimensional tolerance is ±0.001" (0.0254mm).
(4) Dimensional tolerance is ±0.0007" (0.01778mm).
(5) Dimensional tolerance is ±0.0005" (0.0127mm).
(6) Maximum attenuation at 25°C.
(7) Maximum power at 25° C and sea level; derated per paragraph 6.5.4.

★ **Normally 3 day delivery from stock.**

SPC: Silver-plated copper
SPCW: Silver-plated copper-clad steel
SPNiCW: Silver-plated, nickel-coated, copper-clad steel

NOTE: Cables not marked with a star (★) are expected to be qualified.

MECHANICAL & ELECTRICAL SPECIFICATIONS

Maximum Weight (lbs/100') / kg/100m	Dimensional Stability		Center Conductor Adhesion		Capacitance Maximum (pF/ft) / pf/m	Continuous Working Voltage Maximum (VRMS)	Voltage Withstanding (VRMS)	Operating Frequency Maximum (GHz)
	Temperature (°C)	Maximum Dimension (inches/mm)	Minimum (lbs/kg)	Maximum (lbs/kg)				
10.5/15.6	125	0.015/0.38	4/1.81	100/45.4	29.6/97.12	3000	7500	18.0
10.6/15.8	125	0.015/0.38	4/1.81	100/45.4	29.6/97.12	3000	7500	18.0
3.44/5.12	125	0.015/0.38	4/1.81	65/29.48	29.9/98.10	1900	5000	20.0
3.44/5.12	125	0.015/0.38	4/1.81	65/29.48	29.9/98.10	1900	5000	20.0
3.51/5.22	125	0.015/0.38	4/1.81	65/29.48	29.9/98.10	1900	5000	20.0
3.51/5.22	125	0.015/0.38	4/1.81	65/29.48	29.9/98.10	1900	5000	20.0
3.44/5.12	125	0.015/0.38	4/1.81	65/29.48	29.9/98.10	1900	5000	20.0
3.51/5.22	125	0.015/0.38	4/1.81	65/29.48	29.9/98.10	1900	5000	20.0
1.53/2.28	125	0.015/0.38	4/1.81	35/15.88	32.0/105.0	1500	5000	20.0
1.53/2.28	125	0.015/0.38	4/1.81	35/15.88	32.0/105.0	1500	5000	20.0
1.58/2.35	125	0.015/0.38	4/1.81	35/15.88	32.0/105.0	1500	5000	20.0
1.58/2.35	125	0.015/0.38	4/1.81	35/15.88	32.0/105.0	1500	5000	20.0
1.52/2.26	125	0.015/0.38	4/1.81	35/15.88	32.0/105.0	1500	5000	20.0
1.57/2.34	125	0.015/0.38	4/1.81	35/15.88	32.0/105.0	1500	5000	20.0
1.54/2.29	125	0.015/0.38	4/1.81	35/15.88	32.0/105.0	1500	5000	20.0
1.59/2.37	125	0.015/0.38	4/1.81	35/15.88	32.0/105.0	1500	5000	20.0
0.45/0.67	125	0.015/0.38	2/0.91	10/4.536	32.0/105.0	1000	2000	20.0
0.48/0.71	125	0.015/0.38	2/0.91	10/4.536	32.0/105.0	1000	2000	20.0
0.26/0.39	100	0.015/0.38	0.5/0.23	5.5/2.50	32.0/105.0	750	2000	20.0
0.28/0.42	100	0.015/0.38	0.5/0.23	5.5/2.50	32.0/105.0	750	2000	20.0

TABLE 1

Standard General Purpose 50 Ohm Micro-Coax Cables

Standard 50 Ohm Micro-Coax Cables feature low SWR and low attenuation covering the entire microwave spectrum. They have good power handling ability and excellent interface dimensions for SMA, SMB, Type N and TNC connectors.

Cable Properties:

- Copper outer conductors
- Teflon® PTFE dielectrics
- Wide variety of outer conductor diameters
- Capacitance 29.0 pF/ft
- Velocity of propagation 70%

Typical applications:

- Microwave transmission lines
- Amplifier shielding or isolation
- Totally shielded interconnections
- Microwave delay lines

TABLE 2

Standard 50 Ohm Micro-Coax Cables

Supplied in lengths for use in coaxial delay lines or other applications which require continuous lengths. Lengths available from stock are UT-85 Type from 25 to 100 ft.; UT-141A Type from 25 to 150 ft.; UT-250A Type from 25 to 150 ft.

TABLE 3

Ultraminiature 50 Ohm Micro-Coax Cables

Ultraminiature 50 Ohm Micro-Coax Cables give maximum impact of signal clarity. They meet the demands of package density, optimum SWR and attenuation as a function of size. They feature total shielding for the elimination of signal loss and noise, and are ideal for low power, high reliability applications.

Cable properties:

- Copper outer conductor
- Teflon® PTFE & FEP dielectrics
- Capacitance of 29.0 pF/ft
- Ultra miniature sizes
- Velocity of propagation 70%

Typical applications:

- High reliability miniature packages
- Miniature delay lines
- Printed circuit wiring
- High-speed computers

TABLE 4

50 Ohm Micro-Coax Cables with Special Outer Conductors

Aluminum or stainless steel outer conductor materials in 50 Ohm Micro-Coax Cables optimize such properties as resistance to corrosion, the ability to withstand temperature extremes and weight.

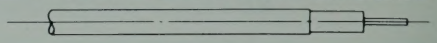
Cable properties and features:

- Solid Teflon® PTFE or FEP dielectrics
- Capacitance 29.0 pF/ft
- Velocity of propagation 70%
- Resistance to corrosion
- Resistance to temperature extremes
- Resistance to short-term nuclear bombardment
- Lightweight

Typical applications:

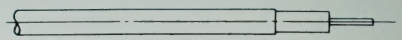
- Any temperature or weight restricted environment circuitry from undersea to outer space conditions

TABLE 1 — UT†† 141A



Micro-Coax Part Number	Nominal Impedance (ohms) and Tolerance / ± ohms	Outer Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Center Conductor Diameter (inches/mm) Nominal
UT 85 ★	50.0/1.5	0.0865/2.20 • ‡	0.066/1.68	0.0201/0.51
UT 85SJ ★	50.0/1.5	0.0865/2.20 •	0.066/1.68	0.0201/0.51
UT 85-C ★	50.0/1.5	0.0865/2.20 • ‡	0.066/1.68	0.0201/0.51
UT 141 ★	49.0/1.0	0.141/3.58 ‡	0.116/2.95	0.0359/0.91
UT 141A ★	50.0/1.0	0.141/3.58 • ‡	0.1175/2.98	0.0359/0.91
UT 141AA	50.0/0.5	0.141/3.58 • ‡	0.1175/2.98	0.0359/0.91
UT 141SJ ★	50.0/1.0	0.141/3.58	0.1175/2.98	0.0359/0.91
UT 141-B	50.0/1.0	0.141/3.58 ‡	0.1175/2.98	0.0359/0.91
UT 141-C ★	50.0/1.0	0.141/3.58 • ‡	0.1175/2.98	0.0359/0.91
UT 250A ★	50.0/0.5	0.250/6.35 • ‡	0.209/5.31 (2)	0.0640/1.63
UT 325A ★	50.0/1.0	0.325/8.26 (2)	0.285/7.24 (2)	7 x 0.0312/7 x 0.79
UT 390 ★	50.0/0.5	0.390/9.91 (2)	0.332/8.43 (2)	0.102/2.59

TABLE 2 — UT 141-A TYPE

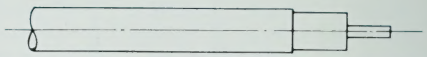


UT 85 Type ★	50.0/3.0	0.0865/2.20 (2)	0.066/1.68 (2)	0.0201/0.51
UT 141A Type ★	50.0/2.0	0.141/3.58 (3)	0.1175/2.98 (3)	0.0359/0.91
UT 250A Type ★	50.0/1.0	0.250/6.35 (3)	0.2085/5.30 (3)	0.0640/1.63

TABLE 3 — UT 34

UT 8 ★	50.0/5.0	0.008/0.20	0.004/0.10	0.002/0.05
UT 13 ★	50.0/4.0	0.013/0.33	0.010/0.25	0.0031/0.08
UT 20 ★	50.0/3.0	0.023/0.58	0.0165/0.42	0.005/0.13
UT 34 ★	50.0/3.0	0.034/0.86 • ‡	0.026/0.66	0.008/0.20
UT 47 ★	50.0/2.5	0.047/1.19 • ‡	0.037/0.94	0.0113/0.29
UT 70-50 ★ (Old No. UT 701)	50.0/2.0	0.070/1.78	0.059/1.50	0.0179/0.45

TABLE 4 — UT 250-AL



UT 20-SS ★	50.0/3.0	0.020/0.51	0.015/0.38	0.0045/0.11
UT 85-SS ★	50.0/1.5	0.0865/2.20	0.066/1.68	0.0201/0.51
UT 141-SS ★	50.0/1.0	0.141/3.58	0.1175/2.98	0.0359/0.91
UT 141A-AL (1100)	50.0/1.5	0.141/3.58	0.1175/2.98	0.0359/0.91
UT 141A-AL (5052)	50.0/1.0	0.141/3.58	0.1175/2.98	0.0359/0.91
UT 250A-AL (1100)	50.0/1.0	0.250/6.35 (2)	0.2085/5.29 (2)	0.064/1.63
UT 250A-AL (5052)	50.0/0.5	0.250/6.35 (2)	0.209/5.31 (2)	0.064/1.63
UT 325A-AL (1100)	50.0/1.5	0.325/8.26 (2)	0.285/7.24 (2)	7 x 0.0312/7 x 0.79

(1) For plated conductor, allow additional 0.001" (0.0254mm).
(2) Dimensional tolerance is ± 0.002" (0.0508mm).
(3) Dimensional tolerance is ± 0.003" (0.0762mm).
(4) Nominal Dielectric Diameter.
(5) Tt/To is defined on page 17.

★ Normally 3 day delivery from stock.

Micro-Coax Components, Inc., Box E, Collegeville, Pa. 19426, U.S.A. ☐ 215/489-3700

†† Registered trademark of UTI Corporation

Standard General Purpose 50 Ohm Micro-Coax Cables

Center Conductor Material	Minimum Inside Bend Radius (inches/mm)	Tt/To (5) (°C)	Weight (lbs/100') / (kg/100m)	Dielectric Strength (VRMS. 60 Hz)	Safe Maximum Voltage Normal Usage (VRMS. 60 Hz)	Higher Order Mode (GHz)	Theoretical Attenuation (dB/100') Power Watts (CW) At 20°C and Sea Level for Unplated Cables				
							0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
SPCW	0.125/3.18	150/100	1.4/2.08	2500	1500	60	13.0/210.6	18.6/147.3	43.8/62.9	64.2/43.0	95.5/29.0
SPCW	0.125/3.18	150/100	1.4/2.08	2500	1500	60	13.0/210.6	18.6/147.3	43.8/62.9	64.2/43.0	95.5/29.0
SPC	0.125/3.18	150/100	1.4/2.08	2500	1500	60	13.0/210.6	18.6/147.3	43.8/62.9	64.2/43.0	95.5/29.0
SPCW	0.188/4.77	175/100	3.2/4.76	5000	1900	34	7.6/673.9	10.9/467.6	26.7/193.8	40.0/129.9	61.2/85.5
SPCW	0.188/4.77	175/100	3.2/4.76	5000	1900	33	7.5/682.8	10.8/473.6	26.3/196.1	39.6/131.3	60.6/86.4
SPCW	0.188/4.77	175/100	3.2/4.76	5000	1900	33	7.5/682.8	10.8/473.6	26.3/196.1	39.6/131.3	60.6/86.4
SPCW	0.188/4.77	175/100	3.2/4.76	5000	1900	33	7.5/682.8	10.8/473.6	26.3/196.1	39.6/131.3	60.6/86.4
SP BeCu	0.188/4.77	175/100	3.2/4.76	5000	1900	33	7.5/682.8	10.8/473.6	26.3/196.1	39.6/131.3	60.6/86.4
SPC	0.188/4.77	175/100	3.2/4.76	5000	1900	33	7.5/682.8	10.8/473.6	26.3/196.1	39.6/131.3	60.6/86.4
SPC	0.375/9.53	150/90	10.0/14.88	7500	3000	19	4.4/1493.7	6.4/1022.0	16.5/402.0	25.7/260.8	41.0/165.1
SPC	0.750/19.05	150/90	14.5/21.58	7500	3000	14	3.3/2452.0	4.9/1660.5	13.2/630.1	21.0/400.1	34.3/247.2
SPC	0.750/19.05	200/90	25.0/37.2	12,000	6000	12	2.9/3914.3	4.33/2636.9	11.9/983.1	19.1/618.1	31.7/377.8

Standard 50 Ohm Micro-Coax Cables

SPCW	0.125/3.18	150/100	1.4/2.08	2500	1500	60	13.0/210.6	18.6/147.3	43.8/62.9	64.2/43.0	95.5/29.0
SPCW	0.250/6.35	150/100	3.2/4.76	5000	1900	33	7.5/682.8	10.8/473.6	26.3/196.1	39.6/131.3	60.6/86.4
SPC	0.375/9.52	150/90	10.0/14.88	7500	3000	19	4.4/1493.7	6.4/1022.0	16.5/402.0	25.7/260.8	41.0/165.1

Ultra Miniature 50 Ohm Micro-Coax Cables

C	0.032/0.81	200/150	0.10/0.15	250	150	877	136.3/3.4	192.9/2.4	433.6/1.0	615.5/0.7	875.1/0.5
SPCW	0.063/1.60	100/85	0.10/0.15	250	150	402	82.4/3.9	116.8/2.7	263.3/1.2	374.7/0.8	534.6/0.6
SPCW	0.063/1.60	100/85	0.10/0.15	750	500	240	51.0/10.2	72.3/7.2	163.9/3.1	234.1/2.2	335.7/1.5
SPCW	0.125/3.18	125/100	0.19/0.28	2000	750	150	32.1/30.5	45.7/21.4	104.3/9.4	149.8/6.5	216.5/4.5
SPCW	0.125/3.18	125/100	0.38/0.56	2000	1000	109	22.8/56.0	32.5/39.3	74.9/17.1	108.2/11.8	157.7/8.1
SPC	0.125/3.18	150/145	0.79/1.17	2300	1200	68	14.5/159	20.7/111.4	48.5/47.8	70.9/32.7	104.9/22.1

50 Ohm Micro-Coax Cables with Special Outer Conductors

SPCW	0.125/3.18	175/150	0.10/0.15	750	500	240	128.5/8.5	181.9/6.0	409.0/2.6	580.7/1.8	825.9/1.3
SPCW	0.250/6.35	225/200	1.3/1.93	2500	1500	60	29.7/165.2	42.3/116.2	96.7/50.9	139.1/35.5	201.4/24.6
SPCW	0.375/9.52	250/240	3.1/4.61	5000	1900	33	16.9/399.2	24.1/279.9	56.1/120.9	81.7/83.3	120.2/56.9
SPCW	0.188/4.77	150/85	1.9/2.83	5000	1900	33	8.0/402.8	11.6/279.7	28.0/116.2	42.0/78.0	64.0/51.5
SPCW	0.250/6.35	175/110	1.9/2.83	5000	1900	33	8.6/462.2	12.4/321.4	30.0/134.3	44.7/90.6	67.9/60.1
SPC	0.375/9.53	175/80	6.4/9.52	7500	3000	19	4.7/1329.8	6.8/912.1	17.5/362.0	27.1/236.1	42.9/150.4
SPC	0.375/9.53	200/90	6.4/9.52	7500	3000	19	5.0/1461.6	7.3/1004.9	18.6/402.5	28.6/263.9	45.1/169.2
SPC	0.750/19.05	175/80	10.5/15.6	7500	3000	14	3.5/2161.3	5.2/1468.1	13.9/563.1	22.0/359.8	35.7/223.9

*: Tin-plated (TP)
‡: Silver-plated (SP)
C or CU: Copper
SPC: Silver-plated copper
SPCW: Silver-plated copper-clad steel
SPNiCW: Silver-plated, nickel-coated, copper-clad steel
SJ: Soft-jacketed

SPBeCu: Silver-plated beryllium copper
SPCT: Silver-plated copper tube
AL: Aluminum
SS: Type 304 stainless steel
PTFE: Polytetrafluoroethylene
PFA: Perfluoroalkoxy

TABLE 5

Ultramalleable 50 Ohm Micro-Coax Cables

50 Ohm ultramalleable cables provide a unique solution to packaging and performance requirements at a slight sacrifice in SWR and impedance matching. These cables possess 3 to 5 times as much power handling ability as standard Micro-Coax Cables. They can be soldered to any ground plane at any point without fear of outer conductor failure and they can be bent to fit practically any package requirement.

Cable properties and typical applications

The properties and applications are identical to those of ultraminiature cable (Table 3) where sacrifices can be made to attain a higher power rating and ease of soldering and bending, i.e., compromises in SWR.

TABLE 5 — UT 34M

Micro-Coax Part Number	Nominal Impedance (ohms) and Tolerance / ± ohms	Outer Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Center Conductor Diameter (inches/mm) Nominal
UT 20-M	50.0/8.0	0.023/0.58	0.015/0.38 (4)	0.0045/0.114
UT 34-M ★	50.0/6.0	0.0375/0.95	0.024/0.61 (4)	0.008/0.203
UT 47-M	50.0/4.0	0.050/1.27	0.037/0.94 (4)	0.0113/0.287

TABLE 6

10, 15, 25, 70, 75, 93 and 95 Ohm Micro-Coax Cables

Copper jacketed cables designed to meet close tolerances in both impedance and capacitance. Sizes range from 0.034" (0.86mm) through 0.250" (6.35mm). Total shielding eliminates undersized coupling while copper jacket facilitates direct soldering.

Cable properties:

Copper outer conductors
Teflon® PTFE dielectric
Velocity of propagation 70%
Total shielding

Typical applications:

CATV amplifier wiring
Capacitor sections
Low impedance matching for solid state units
Quarter wave transformer sections

TABLE 6 — UT 85-75

Micro-Coax Part Number	Nominal Impedance (ohms) and Tolerance / ± ohms	Outer Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Center Conductor Diameter (inches/mm) Nominal
UT 34-25 ★ (Old No. UT 25)	25/3.0	0.034/0.86	0.023/0.58	0.0126/0.32
UT 34-95 ★	95/4.0	0.034/0.86	0.027/0.69	0.0028/0.07
UT 47-70 ★	70/3.0	0.047/1.19	0.0375/0.95	0.0071/0.18
UT 43-10 ★	10/3.0	0.043/1.09	0.036/0.91	0.028/0.71
UT 90-25 ★	25/2.0	0.090/2.29	0.073/1.85	0.040/1.02
UT 85-70 ★	70/2.0	0.085/2.16 *	0.060/1.52	0.0113/0.29
UT 85-75 ★	75/2.0	0.085/2.16 *	0.067/1.70	0.0113/0.29
UT 85-93 ★	93/2.0	0.085/2.16	0.073/1.85	0.008/0.20
UT 130-93 ★	93/2.0	0.130/3.30	0.103/2.62	0.0113/0.29
UT 141-15 ★	15/3.0	0.141/3.58	0.114/2.90	0.080/2.03
UT 141-70 ★	70/2.0	0.141/3.58	0.107/2.72	0.0201/0.51
UT 141-70-C	70/2.0	0.141/3.58	0.107/2.72	0.0201/0.51
UT 141-75 ★	75/1.0	0.141/3.58 *	0.117/2.97 (2)	0.0201/0.51
UT 141-75-C	75/1.0	0.141/3.58	0.117/2.97 (2)	0.0201/0.51
UT 250-75	75/1.5	0.250/6.35	0.214/5.44	0.0359/0.91

TABLE 7

Air Articulated (Spline) 50 Ohm Cables

Air articulated cables provide excellent impedance matching, low weight, low loss transmission lines. Although special care must be taken in bending and installation of these cables, they provide properties not found in solid dielectric cables.

Cable properties:

Low attenuation
Low weight
Copper or aluminum outer conductors
Tubular copper center conductors
Teflon® PTFE spline dielectrics

Typical applications:

Spacecraft interconnections
Antenna feed cables
Liquid level sensing devices
Low loss receivers

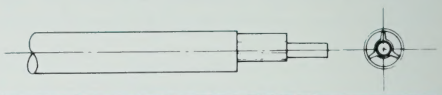


TABLE 7 — UT S-250

Micro-Coax Part Number	Outer Conductor (1) Diameter (inches/mm) ± 0.002" / ± 0.0508mm	Dielectric Diameter (inches/mm) ± 0.002" / ± 0.0508mm	Number of TFE Splines	Center Conductor SPCT Diameter ± 0.001" / ± 0.0254mm
OFHC COPPER				
UT S-250	0.250/6.35	0.221/5.61	3	0.086/2.18
UT S-325	0.325/8.26	0.285/7.24	5	0.110/2.79
UT S-375	0.375/9.53	0.325/8.26	5	0.126/3.20
UT S-390	0.390/9.91	0.340/8.64	5	0.136/3.45
UT S-500	0.500/12.71	0.450/11.43	5	0.174/4.42
1100 ALUMINUM				
UT S-250-AL	0.250/6.35	0.221/5.61	3	0.086/2.18
UT S-325-AL	0.325/8.26	0.285/7.24	5	0.110/2.79
UT S-390-AL	0.390/9.91	0.340/8.64	5	0.136/3.45
UT S-500-AL	0.500/12.71	0.450/11.43	5	0.174/4.42

(1) For plated conductor, allow additional 0.001" (0.0254mm).
(2) Dimensional tolerance is ± 0.002" (0.0508mm).
(3) Dimensional tolerance is ± 0.003" (0.0762mm).
(4) Nominal Dielectric Diameter.
(5) Tt/To is defined on page 17.

*: Tin-plated (TP)
‡: Silver-plated (SP)
C or CU: Copper
SPC: Silver-plated copper
SPCW: Silver-plated copper-clad steel
SPNiCW: Silver-plated, nickel-coated, copper-clad steel
SJ: Soft-jacketed
SPBeCu: Silver-plated beryllium copper
SPCT: Silver-plated copper tube
AL: Aluminum
SS: Type 304 stainless steel
PTFE: Polytetrafluoroethylene
PFA: Perfluoroalkoxy

★ **Normally 3 day delivery from stock.**

Ultra Malleable 50 Ohm Micro-Coax Cables

Center Conductor Material	Minimum Inside Bend Radius (inches/mm)	T_I/T_O (°C)	Weight (lbs/100') / (Kg/100m)	Dielectric Strength (VRMS, 60 Hz)	Safe Maximum Voltage, Normal Usage (VRMS, 60 Hz)	Higher Order Mode (GHz)	Theoretical Attenuation (dB/100')/Power Watts (CW) At 20°C and Sea Level for Unplated Cables				
							0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
SPCW	0.032/0.81	200/175	0.10/0.149	750	500	240	51.0/27.8	72.3/19.6	163.9/8.6	234.1/6.0	335.7/4.2
SPCW	0.063/1.60	225/200	0.27/0.402	2000	750	150	32.1/76.5	45.7/53.8	104.3/23.6	149.8/16.5	216.5/11.4
SPCW	0.063/1.60	250/230	0.45/0.670	2000	1000	109	22.4/149.1	31.9/104.7	73.6/45.5	106.4/31.5	155.2/21.7

10, 15, 25, 70, 93 and 95 Ohm Micro-Coax Cables

Center Conductor Material	Minimum Inside Bend Radius (inches/mm)	T_I/T_O (°C)	Capacitance (pF/ft) / pF/m	Dielectric Strength (VRMS, 60 Hz)	Safe Maximum Voltage, Normal Usage (VRMS, 60 Hz)	Higher Order Mode (GHz)	Theoretical Attenuation (dB/100')/Power Watts (CW) At 20°C and Sea Level for Unplated Cables				
							0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
SPCW	0.125/3.18	125/100	58.5/191.9	500	200	143.7	48.1/20.8	68.2/14.6	154.8/6.4	221.2/4.5	317.4/3.1
SPCW	0.125/3.18	125/100	15.4/50.52	2000	1000	176.6	40.7/24.2	57.7/17.0	131.3/7.5	188.0/5.2	270.5/3.6
SPCW	0.125/3.18	100/85	20.6/67.58	2000	1000	118.0	23.6/38.8	33.6/27.2	77.4/11.8	111.8/8.2	162.7/5.6
C	0.188/4.78	125/100	145.0/475.7	500	200	81.0	62.0/20.3	87.9/14.3	198.8/6.3	283.5/4.4	405.5/3.1
SPC	0.125/3.18	175/100	58.5/191.9	1000	750	46.0	15.4/232.9	22.0/163.1	51.5/70.1	75.1/48.2	110.9/32.8
SPCW	0.125/3.18	175/150	20.6/67.58	2000	1200	78.0	15.0/224.3	21.4/157.1	50.1/67.5	73.1/46.4	108.1/31.5
SPCW	0.125/3.18	150/140	15.6/51.18	2500	1200	67.0	13.8/149.1	19.7/104.3	46.3/44.6	67.8/30.5	100.5/20.7
SPCW	0.125/3.18	150/140	15.6/51.18	2500	1200	65.0	14.9/179.5	21.3/125.7	49.7/54.0	72.6/37.1	107.4/25.2
SPCW	0.188/4.78	175/100	15.6/51.18	3000	1500	45.0	10.6/440.2	15.3/307.2	36.4/130.1	53.8/88.5	80.7/59.4
SPC	0.250/6.35	175/150	97.0/318.2	1000	750	27.0	14.2/361.1	20.3/252.7	47.5/108.4	69.5/74.3	102.9/50.4
SPCW	0.188/4.78	175/90	20.6/67.58	5000	2000	41.0	8.6/591.4	12.4/411.3	29.9/171.9	44.6/115.9	67.7/76.9
SPC	0.250/6.35	175/90	20.6/67.58	5000	2000	41.0	8.6/591.4	12.4/411.3	29.9/171.9	44.6/115.9	67.7/76.9
SPCW	0.250/6.35	175/90	19.3/63.32	5000	2000	38.0	7.9/630.6	11.5/438.1	27.8/182.4	41.7/122.6	63.6/81.1
SPC	0.250/6.35	175/90	19.3/63.32	5000	2000	38.0	7.9/630.6	11.5/438.1	27.8/182.4	41.7/122.6	63.6/81.1
SPCW	0.375/9.52	200/90	19.3/63.32	7500	3000	21.0	4.6/1653.0	6.7/1133.7	17.3/449.9	26.7/293.4	42.5/186.9

Air Articulated (Spline) 50 Ohm Cables

Center Conductor Inside Diameter ± 0.002" / ±0.058mm	Minimum Inside Bend Radius (inches/mm)	T_I/T_O (°C)	Weight (lbs/100') / (Kg/100m)	Dielectric Strength (VRMS, 60 Hz)	Safe Maximum Voltage, Normal Usage (VRMS, 60 Hz)	Higher Order Mode (GHz)	Theoretical Attenuation (dB/100')/Power Watts (CW) At 20°C and Sea Level for Unplated Cables				
							0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	12.0 GHz
0.066/1.68	3.0/76.20	200/150	5.6/8.333	4000	1400	21.0	3.5/630.0	5.1/431.0	13.1/169.5	20.4/109.9	23.0/97.7
0.090/2.29	5.0/127.0	200/150	9.5/14.14	5000	2000	16.4	2.8/825.0	4.1/559.6	10.9/213.6	17.3/136.1	19.6/120.3
0.085/2.16	5.0/127.0	200/150	15.0/22.32	5000	2200	14.4	2.5/949.4	3.7/640.8	9.9/240.4	15.9/151.7	18.1/133.8
0.096/2.44	5.0/127.0	200/150	16.3/24.25	5000	2200	13.6	2.3/1012.3	3.5/682.3	9.5/254.7	15.3/160.3	17.4/141.3
0.134/3.40	6.0/152.4	200/150	21.0/31.25	7500	3000	10.4	1.9/1304.9	2.8/867.8	8.1/310.1	13.3/190.6	—
0.066/1.68	3.0/76.20	200/125	2.6/3.868	4000	1400	21.0	3.7/553.6	5.5/379.6	14.0/150.6	21.6/98.2	24.4/87.4
0.090/2.29	5.0/127.0	200/125	4.5/66.96	5000	2000	16.4	3.0/729.7	4.4/496.4	11.6/191.4	18.3/122.6	20.7/108.6
0.096/2.44	5.0/127.0	200/125	7.5/11.16	5000	2200	13.6	2.5/896.6	3.7/606.3	10.1/229.0	16.1/145.0	18.3/128.0
0.134/3.40	6.0/152.4	200/125	11.0/16.37	7500	3000	10.4	1.9/1067.1	2.8/779.3	8.1/282.2	13.3/174.6	—

TABLE 8

High Temperature Micro-Coax Cables

High temperature Micro-Coax Cables primarily utilize dielectrics of magnesia to withstand temperatures exceeding 250° C or nuclear particle flux. The temperature limitation of the resultant cable then becomes the softening point of the lowest melting point conductor.

Since these dielectrics are in powdered form, they require hermetically sealed connectors.

Cable properties:

Wide selection of outer conductor materials
MgO dielectric
Varied selection of center conductor materials

Typical applications:

Any high temperature application
Cables to support and transmit in nuclear environment

TABLE 9

Cryogenic Feed and High Pressure 50 Ohm Cables

These cables are available on special order, and are custom designed to meet heat transfer rates within allowable loss parameters.

Cables can be offered with tubular center conductors to minimize the cross-sectional area of the conductor with no loss of performance in the microwave signal spectrum. Careful connector selection is mandatory.

Cable properties:

Tubular outer conductors
Vacuum seals have been achieved with solid conductor cables
Solid Teflon® PTFE dielectrics
Wide selection of electrical conductivity
Wide selection of thermal conductivity

Typical applications:

Dewar input lines
Pump signal feeds
High pressure installations
Corrosive environments

TABLE 10

Superconductive 50 Ohm Micro-Coax Cables

Delay lines and transmission lines operating in cryogenic environments can be manufactured to be superconductive. Normally, a Niobium center conductor is used for strength, lead or Niobium for outer conductors, and a Teflon® PTFE dielectric.

TABLE 11

Triaxial Cables

Triaxial cables (cable within a cable) are an efficient means of carrying 2 distinct signals in one cable. Both inner and outer cables can be closely controlled for impedance and capacitance. Nearly any geometry can be manufactured. If the combination of inner and outer cable is of unequal impedance, it is recommended that the inner cable be the high impedance cable if the wire size is adequate. Equal impedance cables are available as well. Available on special order. Data on request.

(1) For plated conductor, allow additional 0.001" (0.0254mm).
(2) Dimensional tolerance is ± 0.002" (0.0508mm).
(3) Dimensional tolerance is ± 0.003" (0.0762mm).
(4) Nominal Dielectric Diameter.
(5) Tt/To is defined on page 17.

*: Tin-plated (TP)
‡: Silver-plated (SP)
C or CU: Copper
SPC: Silver-plated copper
SPCW: Silver-plated copper-clad steel
SPNiCW: Silver-plated, nickel-coated, copper-clad steel
SJ: Soft-jacketed
SPBeCU: Silver-plated beryllium copper
SPCT: Silver-plated copper tube
AL: Aluminum
SS: Type 304 stainless steel
PTFE: Polytetrafluoroethylene
PFA: Perfluoroalkoxy
FPE: Foamed polyethylene

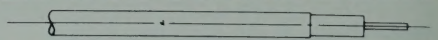


TABLE 8 — UT 141-I

Micro-Coax Part Number	Nominal Impedance (ohms) and Tolerance / ± ohms	Outer Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Center Conductor Diameter (inches/mm) Nominal
UT 85-I	50.0/4.0	0.085/2.16	0.065/1.65	0.009/0.229
UT 141-I	50.0/3.0	0.141/3.58 (2)	0.118/3.00	0.018/0.458
UT 160-C SS-I	50.0/3.0	0.160/4.06 (2)	0.118/3.00	0.018/0.458
UT 250-I	50.0/3.0	0.250/6.35 (2)	0.215/5.46	0.033/0.838
UT 250-I SS	50.0/3.0	0.250/6.35 (2)	0.215/5.46	0.033/0.838

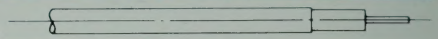


TABLE 9 — UT 141-SS-B

Micro-Coax Part Number	Nominal Impedance (ohms) and Tolerance / ± ohms	Outer Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Center Conductor Outside Diameter (inches/mm) Nominal
UT 20-SS-SS	50.0/3.0	0.020/0.51	0.015/0.38	0.0045/0.11
UT 85-B-B	50.0/1.5	0.0865/2.20	0.066/1.68	0.0201/0.51
UT T-85-B-B	50.0/1.5	0.0865/2.20	0.066/1.68	0.0201/0.51
UT T-85-SS-B	50.0/1.5	0.0865/2.20	0.066/1.68	0.0201/0.51
UT 141-SS-B	50.0/1.0	0.141/3.58	0.1175/2.98	0.0359/0.91
UT 141-SS-SS	50.0/1.0	0.141/3.58	0.1175/2.98	0.0359/0.91
UT T-141-SS-B	50.0/1.0	0.141/3.58	0.1175/2.98	0.0359/0.91
UT 250-B-B	50.0/0.5	0.250/6.35 (2)	0.209/5.31 (2)	0.064/1.63
UT 250-SS	50.0/0.5	0.250/6.35 (2)	0.209/5.31 (2)	0.064/1.63
UT S-250-SS-SS	50.0/1.0	0.250/6.35 (2)	0.221/5.61 (2)	0.087/2.21

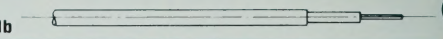


TABLE 10 — UT 85-Pb-Nb

Micro-Coax Part Number	Nominal Impedance (ohms) and Tolerance / ± ohms	Outer Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Center Conductor Outside Diameter (inches/mm) Nominal
UT 85-Pb-Nb	50.0/2.0	0.0865/2.20	0.066/1.68	0.0201/0.51
UT 85-Nb-Nb	50.0/1.5	0.0865/2.20	0.066/1.68	0.0201/0.51
UT 141-Pb-Nb	50.0/1.5	0.141/3.58	0.1175/2.98	0.0359/0.91
UT 141-Nb-Nb	50.0/1.0	0.141/3.58	0.1175/2.98	0.0359/0.91

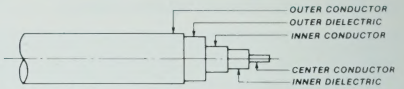


TABLE 11 — UT 325-100-25

Micro-Coax Part Number	Outer Impedance (ohms) and Tolerance / ± ohms	Inner Impedance (ohms) and Tolerance / ± ohms	Outer Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Inner Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm
UT 34-50-50	50.0/3.0	50.0/5.0	0.034/0.86	0.008/0.20
UT 78-50-25	25.0/3.0	50.0/3.0	0.078/1.98	0.034/0.86
UT 85-50-50	50.0/1.5	50.0/2.0	0.085/2.16	0.020/0.51
UT 141-50-50	50.0/1.0	50.0/3.0	0.141/3.58	0.036/0.91
UT 250-35-12.5	12.5/2.0	35.0/2.0	0.250/6.35 (2)	0.141/3.58 (2)
UT 325-100-25	25.0/2.0	100.0/1.0	0.325/8.26 (2)	0.157/3.99 (2)
UT 580-100-100	100.0/4.0	100.0/4.0	0.580/14.73 (3)	0.047/1.19

Micro-Coax Components, Inc., Box E, Collegeville, Pa. 19426, U.S.A. ☐ 215/489-3700

High Temperature Micro-Coax Cables

Outer Conductor Material	Dielectric Material	Center Conductor Material	Minimum Inside Bend Radius (inches/mm)	To [5] (°C)	Theoretical Attenuation (dB/100')/Power Watts (CW) At 20°C and Sea Level for Unplated Cables				
					0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
Cu	MGO	SPCW	0.250/6.35	400	25.6/427.2	36.9/298.2	88.4/126.6	131.4/86.2	198.5/57.9
Cu	MGO	SPCW	0.500/12.7	400	13.5/1207.3	19.7/834.1	50.1/340.2	77.2/225.6	121.8/146.7
SS over Cu	MGO	SPCW	0.750/19.05	475	13.5/2018.5	19.7/1395.1	50.1/570.6	77.2 3/9.1	121.8/247.0
Cu	MGO	SPCW	1.00/25.4	400	7.9/3456.8	11.8/2348.8	32.2/901.7	51.9/576.4	86.1/358.9
SS	MGO	SPCW	1.50/38.1	900	13.0/10273.3	19.0/7113.3	48.5/2924.5	74.9/1950.0	118.6/1276.0

Cryogenic Feed and High Pressure 50 Ohm Cables

Center Conductor Inside Diameter (inches/mm) Nominal	Outer Conductor Material	Dielectric Material	Center Conductor Material	Minimum Inside Bend Radius (inches/mm)	T_I/T_O [5] (°C)	Remarks
Solid	304 SS	PTFE	304 SS	0.250/6.35	175/150	Very low thermal transfer
Solid	BeCu	PTFE	BeCu	0.250/6.35	225/200	Solderable, good attenuation
0.010/0.254	BeCu	PTFE	BeCu	0.250/6.35	225/200	Solderable, good attenuation, low thermal transfer
0.010/0.254	304 SS	PTFE	BeCu	0.250/6.35	225/200	Good attenuation, low thermal transfer
Solid	304 SS	PTFE	BeCu	0.500/12.7	250/240	
Solid	304 SS	PTFE	304 SS	0.500/12.7	250/240	
0.020/0.508	304 SS	PTFE	BeCu	0.500/12.7	250/240	
Solid	BeCu	PTFE	BeCu	1.00/25.4	250/230	
Solid	304 SS	PTFE	SPC	0.750/19.05	250/230	
0.066/1.68	304 SS	Spline	304 SS	1.50/38.1	250/240	Very low loss

Superconductive 50 Ohm Micro-Coax Cables

Center Conductor Inside Diameter (inches/mm) Nominal	Outer Conductor Material	Dielectric Material	Center Conductor Material	Minimum Inside Bend Radius (inches/mm)	Tt[5] (°C)	Remarks
Solid	Pb	PTFE	Nb	0.250/6.35	85	
Solid	Nb	PTFE	Nb	0.250/6.35	150	
Solid	Pb	PTFE	Nb	0.500/12.7	85	
Solid	Nb	PTFE	Nb	0.500/12.7	175	

Triaxial Cables

Center Conductor Diameter (inches/mm) Nominal	Outer Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Inner Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Outer Conductor Material	Inner Conductor Material	Center Conductor Material	Outer Dielectric Material	Inner Dielectric Material
0.002/0.05	0.027/0.69	0.0045/0.11	Copper	Copper	Copper	PTFE	PTFE
0.008/0.20	0.058/1.47	0.026/0.66	Copper	Copper	SPCW	PTFE	PTFE
0.0045/0.11	0.065/1.65	0.015/0.38	Copper	Copper	SPCW	PTFE	PTFE
0.008/0.20	0.1175/2.98	0.026/0.66	Copper	Copper	SPCW	PTFE	PTFE
0.508/1.29	0.190/4.83 (2)	0.117/2.97 (2)	Copper	Copper	SPCW	PTFE	PTFE
0.0113/0.29	0.285/7.24 (2)	0.122/3.10 (2)	Copper	Copper	SPCW	PTFE	PTFE
0.004/0.10	0.500/12.70 (3)	0.037/0.94 (2)	Copper	Copper	SPCW	PTFE	PTFE

TABLES 12, 13 and 14

Special Purpose Micro-Coax Cables

Tables 12, 13 and 14 group special purpose cables by general impedance ranges. They illustrate a small selection of the combinations of the highly specialized, critically controlled cables, conductors, and dielectrics available on special order.

Cable options:

Choice of conductors
Choice of dielectrics
Choice of metallurgical properties

Typical applications:

Medical electronics
Computer
Aerospace
Detectors
Test equipment

TABLE 12 — UT 34-10

Micro-Coax Part Number	Nominal Impedance (ohms) and Tolerance / ± ohms	Outer Conductor (1) Diameter (inches/mm) ± 0.001" / ± 0.0254mm	Outer Conductor Material	Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm
UT 34-10	10.0/4.0	0.034/0.86	Copper	0.025/0.64
UT 34-17	17.0/1.0	0.034/0.86	Copper	0.024/0.61
UT 44-5	5.0/1.0	0.044/1.12	Copper	0.036/0.91
UT 47-35	35.0 1.5	0.047/1.19	Copper	0.037/0.94
UT 70-25	25.0/2.0	0.070/1.78	Copper	0.056/1.42
UT 75-10	10.0/3.0	0.075/1.91	Copper	0.057/1.45
UT 85-15	15.0/2.0	0.0865/2.20	Copper	0.066/1.68 (2)
UT 90-35	35.0/3.0	0.090/2.29	Copper	0.074/1.88
UT 141-10	10.0/1.5	0.141/3.58	Copper	0.1175/3.00
UT 141-25	25.0/1.5	0.141/3.58	Copper	0.116/2.95
UT 141-35 *	35.0/2.0	0.141/3.58	Copper	0.117/2.97
UT 300-25	25.0/2.0	0.300/7.62 (2)	Copper	0.261/6.63 (2)
UT 325-12.5	12.5/2.0	0.325/8.26 (2)	Copper	0.285/7.24 (2)

TABLE 13 — UT 141-AL-C

Micro-Coax Part Number	Nominal Impedance (ohms) and Tolerance / ± ohms	Outer Conductor (1) (Diameter) (inches/mm) ± 0.001" / ± 0.0254mm	Outer Conductor Material	Dielectric Diameter (inches/mm) ± 0.001" / ± 0.0254mm
UT 85-AL	50.0/2.0	0.0865/2.20	1100 AL	0.066/1.68
UT 85-L	50.0/1.5	0.0865/2.20	Copper	0.066/1.68
UT 100-B	53.0/2.0	0.100/2.54	Copper	0.070/1.78
UT 141-AL-C	50.0/1.5	0.141/3.58	1100 AL	0.1175/2.98
UT 141L	50.0/1.0	0.141/3.58	Copper	0.1175/2.98
UT 141-SS-C	50.0/1.0	0.141/3.58	304 SS	0.1175/2.98
UT 141-AL-AL	50.0/1.5	0.141/3.58	1100 AL	0.1175/2.98
UT 141-AL-AL-52	50.0/1.0	0.141/3.58	5052 AL	0.1175/2.98
UT 250-AL-FPE *	50.0/2.0	0.250/6.35(2)	1100 AL	0.214/5.44 (2)

TABLE 14 — UT 250-110

UT 48-75	75.0/3.0	0.048/1.22	Copper	0.037/0.94
UT 85-70-B	70.0/2.0	0.084/2.13	Copper	0.056/1.42
UT 90-70	70.0/2.0	0.090/2.29	Copper	0.074/1.88
UT 90-100	100.0/2.0	0.090/2.29 (2)	Copper	0.075/1.90 (2)
UT 130-93-AL	93.0/2.0	0.130/3.30	1100 AL	0.1055/2.68
UT 130-93-SS	93.0/1.5	0.130/3.30	304 SS	0.1055/2.68
UT 141-100	100.0/2.0	0.141/3.58	Copper	0.1175/2.98
UT 250-110	110.0/2.0	0.250/6.35 (2)	Copper	0.210/5.34 (2)

* Normally 3 day delivery from stock.

(1) For plated conductor, allow additional 0.001" (0.0254mm)
(2) Dimensional tolerance is ± 0.002" (0.0508mm)
(3) Dimensional tolerance is ± 0.003" (0.0762mm)
(4) Nominal Dielectric Diameter
(5) Tt/To is defined on page 17

SPECIAL PURPOSE — LOW IMPEDANCE

Dielectric Material	Center Conductor Diameter (inches / mm) Nominal	Center Conductor Material	Capacitance (pF/ft)	Minimum Inside Bend Radius (inches / mm)	Theoretical Attenuation (dB/100') 0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
PTFE	0.0201	SPC	145.0	0.125	87.5	124.0	279.4	397.4	566.7
PTFE	0.0159	SPC	85.0	0.125	60.1	85.2	192.7	274.9	393.3
PTFE	0.032	SPC	290.0	0.250	115.0	162.8	366.3	520.3	740.4
PTFE	0.016	SPC	41.0	0.125	25.2	35.9	82.5	118.9	172.8
PTFE	0.032	SPC	57.0	0.125	19.5	27.8	64.2	93.2	136.4
PTFE or PFA	0.0453	SPC	145.0	0.250	38.8	55.2	125.5	179.9	259.0
PTFE	0.046	SPC	97.0	0.250	24.3	34.5	79.4	114.7	166.8
PTFE	0.032	SPC	41.0/61.008	0.250/6.35	12.8/278.7	18.3/194.8	43.2/83.1	63.4	94.3
PTFE	0.092	SPC	145.0	0.250/6.35	19.2/275.8	27.4/193.5	63.4	92.0	134.8
PTFE	0.064	SPC	57.0	0.250/6.35	9.8/524.3	14.1/365.3	33.7/153.8	50.0	75.4
PTFE	0.0508	SPC	41.0/61.008	0.250/6.35	8.2/624.9	11.9/434.2	28.7/180.9	42.9	65.4
PTFE	0.144	SPC	57.0/84.816	0.500/12.7	4.6/1677.6	6.7/1149.1	17.2/453.9	26.6	42.3
PTFE	0.213	SPCT	117.0/174.10	0.750/19.05	6.8/1193.0	9.8/825.8	24.1/339.2	36.4	56.1

SPECIAL PURPOSE MICRO-COAX — 50 Ohms

Dielectric Material	Center Conductor Diameter (inches/mm) Nominal	Center Conductor Material	Minimum Inside Bend Radius (inches/mm)	Theoretical Attenuation (dB/100') At 20°C and Sea Le 0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
PTFE	0.0201/0.51	SPCW	0.125/3.18	14.0/122.8	20.0/85.9	46.8/36.7	68.6	101.6
PTFE	0.0201/0.51	Tophet C †	0.125/3.18	81.2/33.5	115.1/23.6	259.6/10.5	369.5	527.2
PTFE	0.0201/0.51	SP BeCu	0.250/6.35	12.1/251.4	17.4/175.7	41.0/74.8	60.4	90.0
PTFE	0.0359/0.91	SPC	0.250/6.35	8.0/402.8	11.6/279.7	28.0/	42.0	64.0
PTFE	0.0359/0.91	Tophet C †	0.250/6.35	45.0/110.3	57.5/87.8	130.0/34.4	187.0/24.0	268.0
PTFE	0.0359/0.91	SPC	0.250/6.35	16.9/399.2	24.1/279.9	56.1/120.9	81.7/83.3	120.2
PTFE	0.0359/0.91	1100 AL	0.250/6.35	9.8/329.4	14.0/229.4	33.6/96.5	49.8/66.4	75.0
PTFE	0.0359/0.91	1100 AL	0.250/6.35	10.4/382.8	14.9/265.9	35.5/112.8	52.5/78.7	78.9
FPE	0.0755/1.92	Copper	0.375/9.52	4.2/280.8	6.1/192.2	16.3/75.7	25.3/44.1	—

† = Trademark Driver-Harris Company

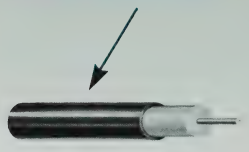
SPECIAL PURPOSE — HIGH IMPEDANCE

PTFE	0.0063/0.16	SPCW	0.125/3.18	24.4/37.8	34.8/26.6	80.0/11.6	115.4	167.9
PTFE	0.0113/0.29	SP BeCu	0.125/3.18	15.1/211.0	21.6/147.9	50.6/64.7	73.9/46.3	109.1
PTFE	0.0142/0.36	SPCW	0.125/3.18	12.0/178.0	17.2/124.3	40.8/52.9	60.0/38.3	89.4
PTFE	0.0069/0.18	SPCW	0.125/3.18	15.8/136.5	22.5/95.6	52.5/41.1	76.6	113.0
PTFE	0.0113/0.29	SPCW	0.188/4.78	10.9/276.3	15.7/192.8	37.3/81.6	55.1/59.2	82.5
PTFE	0.0113/0.29	SPCW	0.250/6.35	16.3/324.7	23.2/227.6	54.1/98.1	78.8/71.0	116.1
PTFE	0.0108/0.27	SPCW	0.250/6.35	10.2/393.7	14.7/274.5	35.0/115.9	51.8/84.0	77.9
PTFE	0.0159/0.40	SPCW	0.250/6.35	6.4/754.5	9.2/521.8	22.8/213.5	34.6/117.1	53.6

*: Tin-plated (TP)
‡: Silver-plated (SP)
C or CU: Copper
SPC: Silver-plated copper
SPCW: Silver-plated copper-clad steel
SPNiCW: Silver-plated, nickel-coated, copper-clad steel
SJ: Soft-jacketed

SPBeCU: Silver-plated beryllium copper
SPCT: Silver-plated copper tube
AL: Aluminum
SS: Type 304 stainless steel
PTFE: Polytetrafluoroethylene
PFA: Perfluoroalkoxy
FPE: Foamed polyethylene

THE OUTER CONDUCTOR



Function: To minimize power loss. The OD or outer surface maximizes the mechanical integrity of the cable and provides the desired interface with standard or special connections. The ID or inner surface of the outer conductor acts as a conductor.

Materials: Seamless copper tubing is frequently used as the outer conductor in Micro-Coax Cables. Design considerations may dictate the selection of another material based on the properties that are most important in a specific application. See Guide to Outer Conductor Selection below.

Properties: Extremely close tolerances in ID and OD of the outer conductor must be maintained throughout the entire length of a cable so that exact performance data can be established.

Platings and Finishes: Platings and finishes used on outer conductors are electro-deposited. While direct plating on copper base alloys is practical, gold is usually plated over a silver strike or under-plate. Other outer conductor materials, such as aluminum, require a copper strike or under-plate prior to the final plating operation. There are many plating options to meet unusual environmental conditions, such as salt spray or high humidity, as well as for cosmetic appearance and solderability. See Platings and Finishes for Outer and Center Conductors below. For finishes other than those shown, consult Micro-Coax Components.

GUIDE TO OUTER CONDUCTOR SELECTION

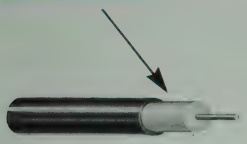
Outer Conductor Material	High Frequency Conductivity	Low Frequency Conductivity	Ease of Soldering	Strength	Weight	Machinability	Corrosion Resistance	Thermal Conductivity
Copper	E	E	E	G	H	F	P	H
Aluminum 1100	F	F	S	P	L	P	P	H
Aluminum 5200	F	F	S	G	L	F	P	H
Beryllium Copper	F	F	E	E	H	F	G	L
Stainless Steel	P	P	S	E	H	G	E	L
Stainless Steel over Copper	E	P	S	E	H	G	E	L
Silver	E	E	E	P	H	F	P	H
Lead	F§	F§	G	P	H	P	P	VL
Phosphor Bronze	F	F	G	E	H	G	E	H
Invar	F	F	S	E	H	G	E	VL
Niobium	F§	F§	P	E	H	P	F	VL
Brass 70/30	F	F	E	E	H	E	G	H

E = Excellent; G = Good; F = Fair; P = Poor; H = High; L = Low; VL = Very Low; S = Special Process
§ = Superconductive at cryogenic temperatures

PLATINGS AND FINISHES FOR OUTER AND CENTER CONDUCTORS

Plating Material	Specification	Part Number Suffix	Remarks
Silver	QQ-S-365, Type II, Class A	SP	Standard on all copper wire. Meets environmental specs and allows soldering without flux.
Tin	MIL-T-10727A, Type I	TP	Lower cost than silver but not as cosmetically pleasing. Improved solderability. Does not tarnish easily.
Gold	MIL-G-45204 Type II	GP	Excellent corrosion resistance, very high cost. Available on special order only.
Solder	60/40 SnPb	EDS	Very good solderability, costs more than tin or cadmium. Easily damaged

DIELECTRIC OR INSULATING MATERIAL



Function: In Micro-Coax, the dielectric material between the outer and center conductors maintains the spacing and geometry of the cable and assures mechanical integrity during forming and bending, or under pressure. The outer conductor can also be insulated to give added resistance to electrical breakdown, abrasion, cut-through, and chemical solvents, or where packaging requires that the cable must be isolated from other circuit components.

Materials: The Guide to Dielectrics and Insulating Jackets below gives performance information on the most commonly used dielectric or insulating materials. As a general rule, the lower the dielectric constant, the lower the bulk loss and attenuation, and the higher the velocity of propagation of the cable. An additional selection factor, not shown in the table, is the ability to bond to conductors and/or other plastics.

GUIDE TO DIELECTRICS AND INSULATING JACKETS

Dielectric Material	Dielectric Constant	Loss Tangent	Resistance to Chemicals	Resistance to Moisture	Resistance to Radiation	Dielectric Strength	Cut-through Resistance	Mechanical Strength	Temperature Stability
Teflon, Solid, TFE (1)	VL	E	E	E	P	E	G	E	VG
Teflon, Solid, FEP (2)	VL	G	E	E	P	E	G	E	G
Teflon, Spline, TFE (1)	VL	U	E	G	P	E	F	F	G
Tefzel (3)	FL	G	E	E	G	E	E	E	G
Polyolefin, Solid	FL	F	F	E	F	G	G	E	F
Polyolefin, Foam	VL	G	F	G	F	G	F	F	F
Polyolefin, Irradiated	FL	F	F	E	F	G	G	E	F
H. Film	FL	G	G	G	F	F	E	E	G
Polyvinlychloride	VH	F	G	G	F	G	G	E	F
Mylar (4)	H	F	G	G	G	G	G	G	G
Magnesium Oxide Powder	H	G	P	P	E	G	NA	P	E
Kynar (5)	H	G	G	G	G	G	G	G	G

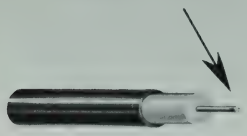
VL = Very Low; FL = Fairly Low; H = High; VH = Very High
U = Superior; E = Excellent; VG = Very Good; G = Good; F = Fair
P = Poor; NA = Not Applicable

(1) — Tetrafluoroethylene (duPont TM)
(2) — Fluorinated Ethylene Propylene (duPont TM)
(3) — Polymer of ethylene and tetrafluorethylene (duPont TM)
(4) — Polyethylene Terrephthalate (duPont tradename)
(5) — Polyvinylidene Fluoride (Pennwalt Corp. tradename)

ELECTRICAL AND PHYSICAL PROPERTIES OF DIELECTRICS

Dielectric Material	Dielectric Constant 10^3 Hz	Dissipation Factor 10^3 Hz	Volume Resistivity Ohm-cm	Maximum Service Temp. °C
PTFE Solid	2.03	0.0002	10^{18}	250
PTFE Spline	1.35	0.0002	—	250
FEP	2.10	0.0007	10^{18}	200
Polyethylene Solid	2.35	0.0003	10^{16}	100
Polyethylene Foamed	1.7-2.3	0.0005	10^{12}	100
Tefzel	2.30	0.005	10^{16}	150
Polyvinylchloride	3.0-8.0	0.07-0.16	10^{12}	105
Nylon	3.5-4.6	0.04	10^{14}	120
Silicone Rubber	3.50	0.020	10^{13}	200
Kel-F	2.37	0.030	10^{18}	150
Powdered Mgo	6.7	0.0003	10^{8}	1,000

THE CENTER CONDUCTOR



Function: The center conductor, usually of solid metal, is the primary signal carrier in Micro-Coax Cables. Most attenuation occurs on the surface area. A Tubular conductor reduces thermal conductivity without any related reduction in high frequency conductivity, and reduces overall weight in large cables.

Materials: Copper-based or copper-clad wire is frequently used as the center conductor because of excellent high frequency conductivity. Design considerations may dictate the selection of another material based on the properties that are most important in a specific application. See the Guide to Center Conductor Selection below.

Properties: In addition to the material properties in the Selection Guide below, cost is a consideration. A further selection factor in special cases is the ability to minimize the effects of radiation. Consult with Micro-Coax Components.

Platings and Finishes: Center conductors are normally silver-plated to prevent oxidation during manufacture and to improve the solderability of the finished product. For other plating options to meet special requirements, see the table of Platings and Finishes on page 14. For finishes other than those shown, consult with Micro-Coax Components.

GUIDE TO CENTER CONDUCTOR SELECTION

Center Conductor Material	High Frequency Conductivity	Low Frequency Conductivity	Ease of Soldering	Strength	Weight	Thermal Conductivity	Impedance Control
Silver-Plated Copper	E	E	E	L	H	H	G
Silver-Plated C-Clad Steel	E	F	E	H	H	L	E
Unplated Copper	E	E	G	L	H	H	G
Stranded Copper	G	E	E	L	H	H	P
Silver-Plated BeCu	G	F	E	H	H	L	E
Aluminum	G	G	S	VL	L	H	G
Gold	G	G	E	L	H	H	F
Lead	L§	L§	G	VL	H	VL	F
Niobium	L§	L§	P	H	H	L	G
Palladium	L	L	E	H	H	H	G
Stainless Steel	L	L	S	H	H	L	E
Tophet C†	L	L	NA	H	H	L	E
Tungsten	L	L	NA	H	H	L	E
Tubular BeCu	L	L	E	H	L	VL	G
Silver-Plated Tubular BeCu	G	L	E	H	L	VL	G
Silver-Plated St. St. Tube	F	VL	G	H	L	VL	G
Tubular Stainless Steel	L	VL	S	H	L	VL	G
Silver Tube over St. St. Tube	E	L	G	H	L	L	G

E = Excellent; G = Good; F = Fair; P = Poor; H = High; L = Low; VL = Very Low; NA = Not Applicable; S = Special Process.
§ = Superconductive at cryogenic temperatures. All conductors are solid unless otherwise noted. † = Trademark Driver-Harris Company

ELECTRICAL AND PHYSICAL PROPERTIES OF CONDUCTORS

Conductor Material	Ratio: Conductivity Compared to Copper	BTU/Hr./Sq. Ft./°F/Ft. Thermal Conductivity 68°F	In/In/°F x 10^{-6} Thermal Expansion	PSI Yield Strength Annealed
OFHC Copper	1.00:1	226	9.8-68/572°F	10000
DLP Copper	1.04:1	219	9.8-68/572°F	10000
Beryllium Copper 25	4.60:1	68	9.9-68/572°F	20000
Aluminum 1100	1.76:1	128	13.1-68/212°F	5000
Aluminum 5052	2.88:1	80	13.2-68/212°F	13000
304 Stainless Steel	44.8:1	9	9.6-32/212°F	40000
Lead	12.80:1	20	16.3-68°F	—
Niobium	13.20:1	31	3.8-68°F	35000
Fine Silver	1.00:1	242	10.9-68°F	8000
Phosphor Bronze	6.73:1	440	9.9-68°F/572°F	19000
Gold	1.42:1	172	7.9-68°F	—
Tungsten	4.05:1	97	2.5-68°F	220000
Paladium	6.31:1	41	6.5-68°F	5000
Tophet C†	65.1:1	8	7.6-68/212°F	70000

Metric Factors: Cal/Sec/Cm/°C x 2.419 x 10^2 = BTU/Hr/Ft/°F cm/cm/°C x 5/9 = In/In/°F Ksi x .7031 - Kgf/mm^2 † = Trademark Driver-Harris Company

EXPOSURE OF PTFE INSULATED CABLES TO ELEVATED TEMPERATURES

Exposure of cables with PTFE insulation to elevated temperatures causes stressing of the outer conductor, since the thermal expansion coefficient of the core insulation is about ten times greater than that of the metal conductors. The effects of this outer conductor stressing require distinction of two temperature levels as cables are subjected to increasing temperatures.

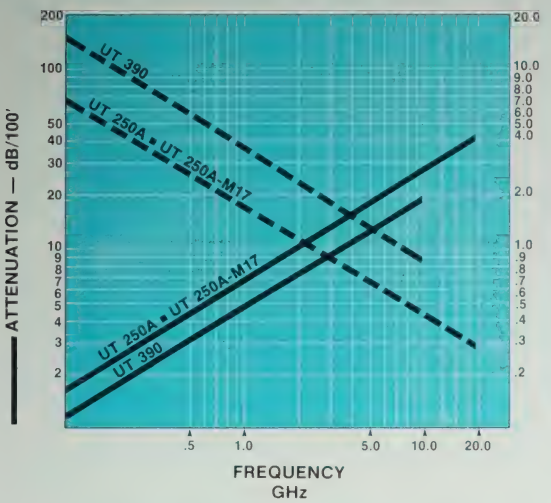
(T_o): Recommended Maximum Operating Temperature

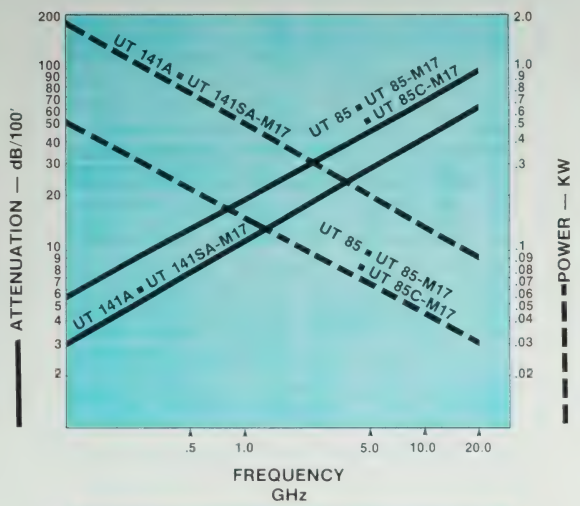
The first significant effect on cable characteristics occurs as the expansive forces on the core material exceed the yield strength of the outer conductor material, so that a permanent increase in the cable outer diameter results. The outer conductor OD increase is accompanied by a permanent increase in impedance, and permanent decrease in capacitance, core adhesion, and corona extinction potential. The temperature at which such changes begin is denoted in this Bulletin as T_o, the maximum recommended operating temperature, which has been determined by testing 1 ft. long specimens until a discernible increase in outer conductor OD was measured on 30% of the number of test specimens.

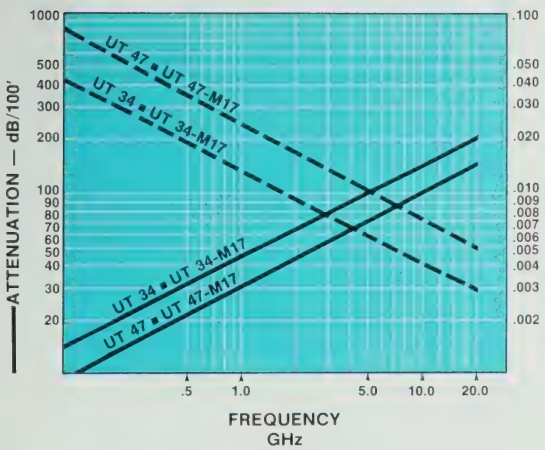
(T_t): Outer Conductor Integrity Test Temperature

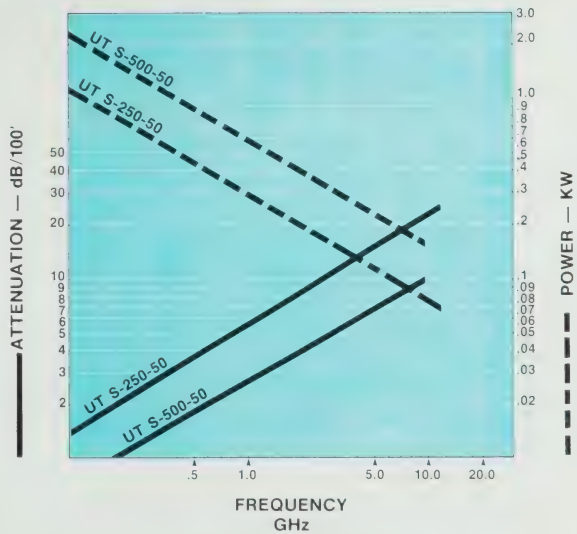
The second significant effect of temperature exposure is to cause catastrophic failure of the outer conductor as the core stresses exceed the tensile strength of the outer conductor material. This temperature is denoted in this Bulletin as T_t, the outer conductor integrity test temprature which has been determined by testing 2 ft. long specimens, with no failures being allowed at the rated temperature. (For test details, refer to MIL-C-17F.)

Attenuation and Average Power Rating For Standard 50 Ohm Micro-Coax Cables









DETERMINING CHANGES IN PHASE OCCURRING WITH CHANGES IN TEMPERATURE

Changes in temperature affect the electrical length of Micro-Coax Semi-Rigid Coaxial Cables. The information provided is intended as a guide for designers as to the approximate phase changes that take place as temperature changes occur.

The information here covers the characteristics of the two most commonly used semi-rigid cables: 1) cable with a solid PTFE dielectric, and 2) cable with a semi-solid (spline) PTFE dielectric. It also includes a quick reference chart for prediction of changes of phase or group delay.

The data disregard minor histeresis effects and are average values. For the temperature range shown, they are not significantly affected by the inner and outer conductor materials.

The data were originally verified by Micro-Coax Components, Inc., 0.4 GHz per paragraph 4.8.14 of MIL-C-17F and subsequently substantiated at 9 GHz for solid PTFE dielectric cable by an independent source.

EXAMPLES FROM TABLE:

At t = -40°C, a solid PTFE loaded cable having an electrical length of 100° at 25°C will have an electrical length of:

$$\boxed{1} + (-35)\ (10^{-6})\ (-65\overline{)}\ \times 100 = 100.23°$$

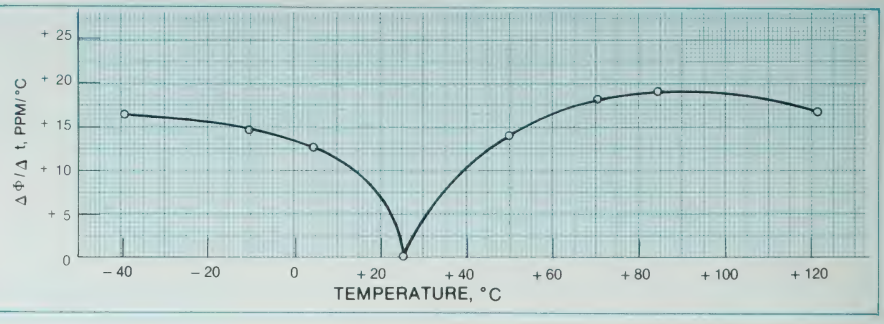
Under identical conditions, the electrical length of a spline-dielectric cable will be:

$$\boxed{1} + (16)\ (10^{-6})\ (-65\overline{)}\ \times 100 = 99.90°$$

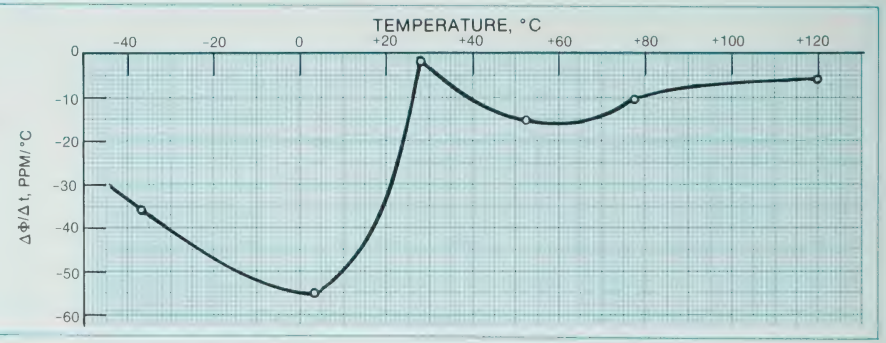
ELECTRICAL LENGTH OR DELAY CHANGE WITH TEMPERATURE

t (°C)	Solid PTFE Coax	Semi-Solid PTFE Coax
-40	1.0023	.9990
-30	1.0021	.9991
-20	1.0019	.9993
-10	1.0017	.9995
0	1.0014	.9996
10	1.0007	.9997
20	1.0001	.9999
30	1.0000	1.0000
40	.9998	1.0002
50	.9996	1.0004
60	.9995	1.0006
70	.9995	1.0008
80	.9995	1.0010
90	.9995	1.0012
100	.9995	1.0014
110	.9995	1.0015
120	.9995	1.0016

PHASE VS. TEMPERATURE COEFFICIENT FOR SEMI-SOLID ("SPLINE") PTFE DIELECTRIC. SEMI-RIGID CABLE WITH 1100 ALLOY ALUMINUM OUTER CONDUCTOR



PHASE VS. TEMPERATURE COEFFICIENT FOR SOLID PTFE LOADED SEMI-RIGID COAX WITH COPPER OUTER CONDUCTOR



Electrical Length at Temperature (t) may be calculated from $L_t = \left[1 + \left(\frac{\Delta\Phi}{\Delta t}\right)(10^{-6})(\Delta t)\right] L_{25}$

WHERE $\Delta\Phi/\Delta t$ = Graph Value

$\Delta t = t - 25$

L_{25} = Electrical Length at 25°C

HELPFUL FORMULAE

CHARACTERISTIC IMPEDANCE:

$$Z_0 = \frac{138}{\sqrt{e}} \log_{10} \frac{D}{d} \quad \text{...ohms}$$

VELOCITY OF PROPAGATION:

$$Vp = \frac{1}{\sqrt{e}} \times 100 \quad \text{...Percent of Free-Space Velocity}$$

CAPACITANCE:

$$C = \frac{7.38e}{\log_{10} \frac{D}{d}} \quad \text{...pF/ft} \qquad C = \frac{24.2e}{\log_{10} \frac{D}{d}} \quad \text{...pF/m}$$

DELAY:

$$T = 1.016 \sqrt{e}\,(L) \quad \text{...ns/ft} \qquad T = 3.33 \sqrt{e}\,(L) \quad \text{...ns/m}$$

$$L = \frac{.984\ T}{\sqrt{e}} \quad \text{...ft/ns} \qquad L = \frac{0.300\ T}{\sqrt{e}} \quad \text{.....m/ns}$$

MODING FREQUENCY:

(At which cable may begin to support a propagation mode in addition to a transverse electromagnetic mode)

$$fco = \frac{7.5}{\sqrt{e}\,(D + d)} \quad \text{....GHz}$$

ATTENUATION (THEORETICAL) AT 20° C:

$$\alpha = \frac{.434}{Z_o} \left[\frac{\sqrt{R_1}}{d} + \frac{\sqrt{R_2}}{D} \right] f^{1/2} + 2.78\ fe^{1/2}\ Fp \quad \text{.....dB/100 ft}$$

Where $R_1 = R_2 = 1.0$ for copper conductors. See table on page 16 for other conductor materials.
To obtain attenuation in dB/m, divide by 30.48
To compute attenuation for temperatures other than 20° C, modify R_1 and R_2 in accordance with the temperature coefficient of resistance of the particular conductor materials. For copper and aluminum, the resistance at temperature t is:

$$R_t = R_{20} [1 + 0.0039\ (t - 20)]^{1/2}$$

CABLE RISE TIME (10% to 90% amplitude):

$$TR = 1.29\ A^2\ L^2 \times 10^{-2} \quad \text{...ps}$$

Note: A and L must be in the same length units, i.e., feet or meters.

CALCULATING AVERAGE POWER RATINGS FOR SEMI-RIGID CABLES WITH SOLID PTFE INSULATION

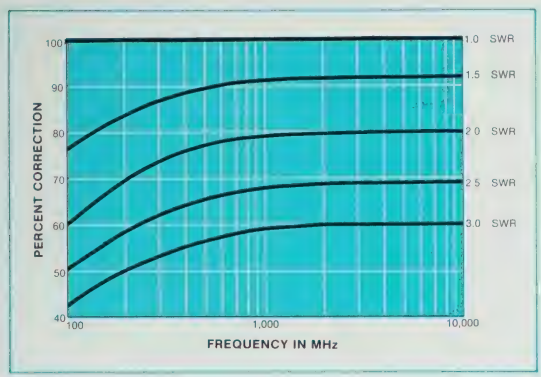
Average Power — Kilowatts

$$P_\alpha = 5.2 \frac{Q/L}{\alpha}$$

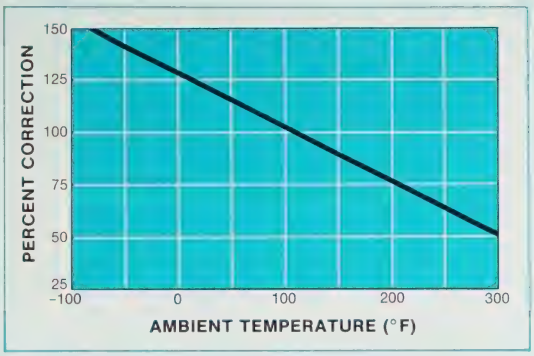
$$Q/L = (hr + hc)\,\pi\,(OD)\quad (to - ta)$$

Center conductor heating:

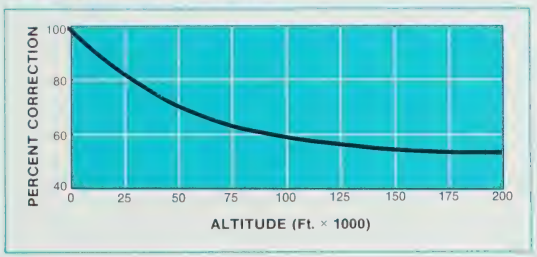
$$t_i = 24.8Rz\ Q/L + t_o$$



SWR CORRECTION FACTOR

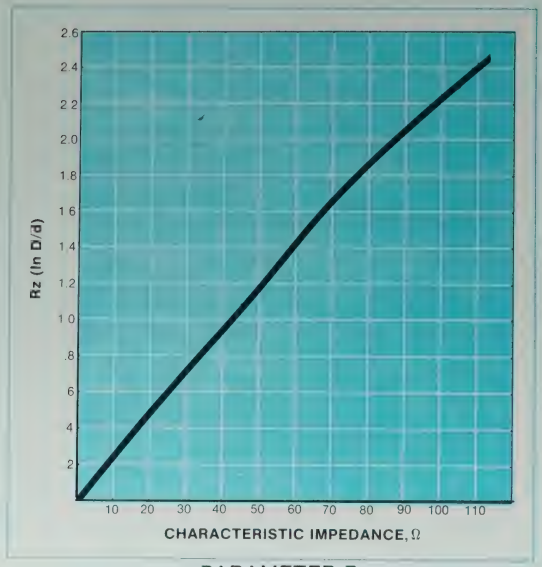


TEMPERATURE CORRECTION — TEFLON DIELECTRIC

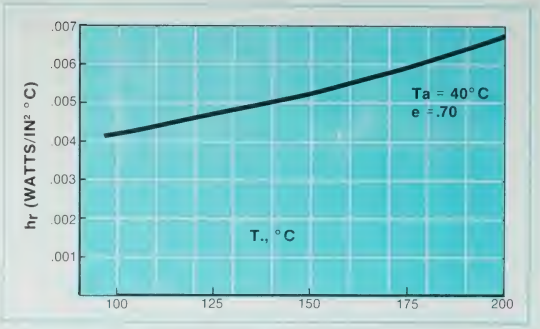


ALTITUDE CORRECTION FACTOR

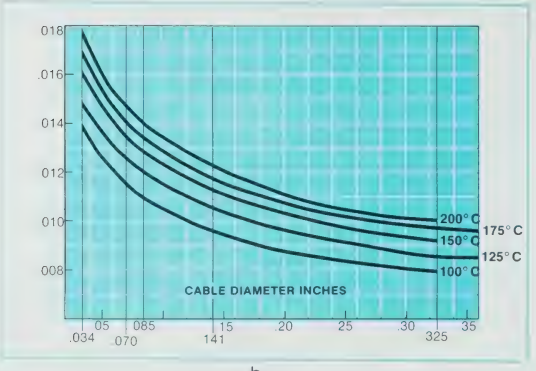
CALCULATING AVERAGE POWER RATINGS



PARAMETER Rz



h_r
THERMAL RADIATION
of COPPER CONDUCTORS



h_c
THERMAL CONVECTION
of COPPER CONDUCTORS

SYMBOLS

e	Dielectric constant
Fp	Power factor or dielectric bulk loss
ρ	Reflection coefficient
SWR	Standing wave ratio
α	Attenuation
A	Attenuation at 1.0 GHz in dB/100 ft.
f	Frequency in MHz
fco	Moding frequency in GHz
R_1	Ratio of center conductor conductivity to copper
R_2	Ratio of outer conductor conductivity to copper
R_t	Resistance of conductor at temperature ta
R_{20}	Resistance of conductor at temperature 20° C
TR	Rise Time
L	Length
T	Time in nanoseconds
T_μ	Time in microseconds
ti	Temperature of inner conductor, °C, -maximum 250° C
to	Temperature of outer conductor, °C -cable rating
ta	Temperature of ambient environment, °C
OD	Outer diameter of cable, inches
ID	Inner diameter of jacket, inches
D	Dielectric diameter, inches
d	Center conductor diameter, inches
a	Waveguide major inner dimension, inches (millimeters)
b	Waveguide minor inner dimension, inches (millimeters)
Z_o	Characteristic impedance
λ_o	Free space wavelength
λ_g	Waveguide wavelength
λ_c	Cut off wavelength

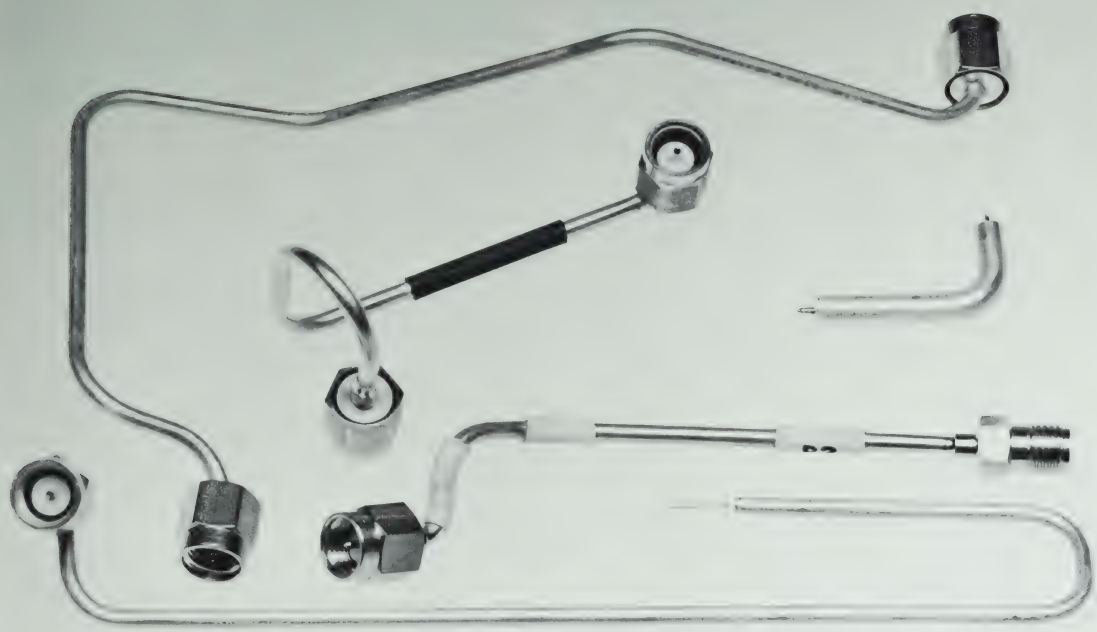
SECTION 2
MICRO-COAX CABLE ASSEMBLIES

The usefulness of semi-rigid coaxial cable is increased by its ability to be formed or fabricated into simple or complex geometric assemblies. Coiling, bending, stripping and soldering, installing connectors and other secondary operations result in the delivery of maximum power in minimum space. All of these forming or fabricating operations can be performed with relative ease.

Fabrication potential of Micro-Coax Cable is practically limitless, meeting mechanical and environmental requirements in phase matching, attenuation and SWR optimization, assembly, encapsulating, insulating, and delay calibration. Impedance transformers, and low-pass, high-pass and bandpass filters can be incorporated within the coaxial cable.

Many equipment manufacturers depend on Micro-Coax Components for finished assemblies, pretested and ready for installation, thus eliminating the need to develop processing techniques and procedures, train personnel, and deal with connector and cable scrap rates.

Custom-designed Micro-Coax Assemblies can insure performance in extreme temperatures, from cryogenic through 250°C or higher, depending on conductor and dielectric materials. Other parameters such as pressure or sealing performance can be integrated into most assemblies.



MICRO-COAX RIGHT-ANGLE COAXIAL CABLE ASSEMBLIES

LOW PROFILE • LOW COST • HIGH RELIABILITY

The simple design of Micro-Coax Components' low-profile Right-Angle Cable Assembly has totally revised traditional concepts of physical space requirements in microwave transmission and delay line applications. Not only does the unique Micro-Coax Right-Angle Cable Assembly mean more effective utilization of space and elimination of unnecessary assembly costs, but it also improves the performance and reliabiliy of the end product. Micro-Coax Components' low profile assembly was achieved with a new technique for bending semi-rigid coaxial cable without causing cross-sectional distortion. By eradicating the angular functions between the contact and the center conductor of the coaxial cable, significantly lower SWR ratings have been achieved.

FEATURES

- Establishes new guidelines for the maximum utilization of space.
- Improves in-service performance predictability by providing greater control over impedance, lower SWR, dielectric strength, attenuation, phase matching, and electrical and mechanical uniformity.
- Reduces costs by eliminating in-house assembly . . . the Micro-Coax Right-Angle Assembly costs are comparable with costs for unassembled cable and a standard SMA connector.
- Available in outside diameters of 0.085" (2.16mm) and 0.141" (3.61mm) and in lengths from 2" (50.8mm) to 48" (1219.2mm).

APPLICATIONS

- In any situation where totally dependable performance is imperative
- In applications where space limitations are severe
- Under circumstances where lower SWR would be especially advantageous

DESIGN BENEFITS

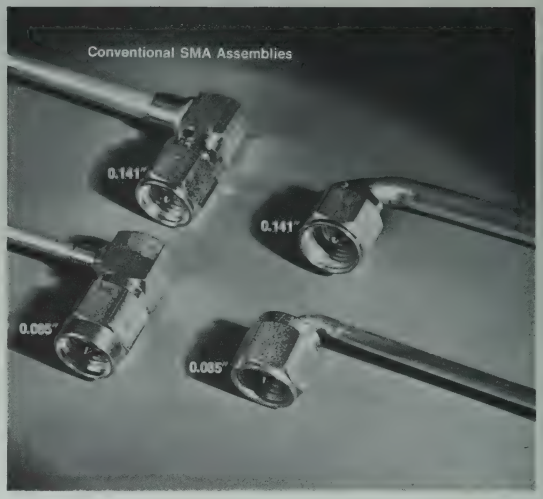
The Micro-Coax Right-Angle Coaxial Cable Assembly is available in two cable sizes — 0.085" (2.16mm) and 0.141" (3.61mm) outside diameters.

Conventional SMA right-angle assemblies have an overall assembly height of 0.675" (17.145mm) and the height from the base of the assembly to the centerline of the cable is 0.535" (13.59mm). Micro-Coax Right-Angle Assemblies have a much lower profile.

Micro-Coax Assemblies fabricated with 0.085" coaxial cable have an overall assembly height of 0.453" (11.506mm) and a distance from the base of the assembly to the centerline of the cable of only 0.410" (10.414mm). Micro-Coax Assemblies fabricated with 0.141" coaxial cable have an overall assembly height of 0.581" (14.757mm) and a height of only 0.515" (13.08mm) from the base of the assembly to the centerline of the cable.

The integrity of the Micro-Coax Right-Angle Assemblies is accomplished by a bending technique that permits forming the 90° angle of the semi-rigid coaxial cable without disturbing the cable properties in any way — electrical and mechanical characteristics are unaffected by the sharp bend. Tight impedance control, dielectric strength, attenuation, and phase matching are among the advantages provided by Micro-Coax Right-Angle Assemblies.

Conventional 0.141" right-angle SMA assemblies have SWR ratings of 1.25:1 to 1.35:1 below 10 GHz. The Micro-Coax Right-Angle Assembly has a rating of 1.10:1 or less up to 12 GHz, and 1.15:1 or less up to 18 GHz.



TECHNICAL DATA

Cable Diameters
Choice of 0.085" (2.16mm) outside diameter or 0.141" (3.61mm) outside diameter.

SWR
1.20:1 or less up to 18 GHz for 0.085" cable. 1.10:1 or less up to 12 GHz, and 1.15:1 up to 18 GHz for 0.141" cable.

Characteristic Impedance
50.0 ± 1.5 ohms for 0.085" cable.
50.0 ± 1.0 ohms for 0.141" cable.

Maximum Voltage
1500 VRMS at 60 Hz for 0.085" cable.
1900 VRMS at 60 Hz for 0.141" cable.

Operating Temperature Range
-55°C to +100°C.

Typical Cable Attenuation

0.085" Cable	0.141" Cable
13.0 dB/100' at 0.5 GHz	7.5 dB/100' at 0.5 GHz
19.0 dB/100' at 1.0 GHz	11.0 dB/100' at 1.0 GHz
44.0 dB/100' at 5.0 GHz	26.0 dB/100' at 5.0 GHz
64.5 dB/100' at 10.0 GHz	39.5 dB/100' at 10.0 GHz
96.0 dB/100' at 20.0 GHz	60.5 dB/100' at 20.0 GHz

Center Conductor Material
Silver-plated, copper-clad steel.

Center Conductor Diameter
0.0201" for 0.085" cable. 0.0359" for 0.141" cable.

Dielectric Material
Teflon TFE

Dielectric Diameter
0.066" for 0.085" cable. 0.1175" to 0.141" cable.

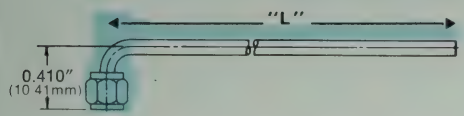
Dielectric Strength
2500 VRMS at 60 Hz for 0.085" cable.
5000 VRMS at 60 Hz for 0.141" cable.

ENGINEERING ASSISTANCE

The engineering staff of the Micro-Coax Components, Inc., is available for consultation on design or technical problems.

SPECIFICATION DATA ON RIGHT ANGLE CABLE ASSEMBLIES

RIGHT-ANGLE MICRO-COAX CABLE ASSEMBLY (UT†† 85-049)



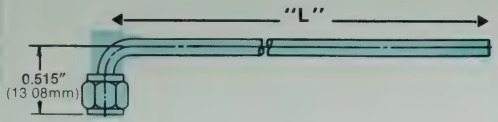
Note the space saving in comparison with a conventional SMA connector shown in blue silhouette.

Micro-Coax Assembly Number Plus	Cable Finish	"L" (inches/mm)
—001	—	2/50.8
—002	TP	2/50.8
—003	—	4/101.6
—004	TP	4/101.6
—005 *	—	6/152.4
—006 *	TP	6/152.4
—007	—	8/203.2
—008	TP	8/203.2
—009	—	10/254
—010	TP	10/254
—011 *	—	12/304.8
—012 *	TP	12/304.8
—013	—	14/355.6
—014	TP	14/355.6
—015	—	16/406.4
—016	TP	16/406.4
—017 *	—	18/457.4
—018 *	TP	18/457.4
—019	—	20/508
—020	TP	20/508
—021	—	22/558.8
—022	TP	22/558.8
—023 *	—	24/609.6
—024 *	TP	24/609.6
—025	—	30/762
—026	TP	30/762
—027	—	36/914.4
—028	TP	36/914.4
—029 *	—	48/1219
—030 *	TP	48/1219

TP: Tin-plated Cable

* Normally 3 day delivery from stock.

RIGHT-ANGLE MICRO-COAX CABLE ASSEMBLY (UT 141-049)



Note the space saving in comparison with a conventional SMA connector shown in blue silhouette.

Micro-Coax Assembly Number Plus	Cable Finish	"L" (inches/mm)
—001	—	2/50.8
—002	TP	2/50.8
—003	—	4/101.6
—004	TP	4/101.6
—005 *	—	6/152.4
—006 *	TP	6/152.4
—007	—	8/203.2
—008	TP	8/203.2
—009	—	10/254
—010	TP	10/254
—011 *	—	12/304.8
—012 *	TP	12/304.8
—013	—	14/355.6
—014	TP	14/355.6
—015	—	16/406.4
—016	TP	16/406.4
—017 *	—	18/457.4
—018 *	TP	18/457.4
—019	—	20/508
—020	TP	20/508
—021	—	22/558.8
—022	TP	22/558.8
—023 *	—	24/609.6
—024 *	TP	24/609.6
—025	—	30/762
—026	TP	30/762
—027	—	36/914.4
—028	TP	36/914.4
—029 *	—	48/1219
—030 *	TP	48/1219

TP: Tin-plated Cable

* Normally 3 day delivery from stock.

DESIGN RECOMMENDATIONS

In designing cable assemblies, Micro-Coax Components, Inc., utilizes and recommends the following design parameters:

- Maintaining constant bend radius or radii to reduce tooling costs.
- Avoiding use of minimum bend radii, to reduce discontinuities. Where practical, the largest constant bend radius is used.
- Taking the connector dimension from the reference plane of the connector interface, because the mating portion of the assembly is the critical performance dimension.
- Using the center line technique shown below to achieve optimum layout.
- Specifying SWR, phase matching and testing level over the band of interest only, since excess specifications increase testing costs.
- Maintaining tolerance of ±0.020" (0.508mm) between bends and on overall height and lengths on short assemblies. Angular tolerances of ±3° are normally adequate. Tighter tolerances can be maintained but they are more expensive.
- Using a plated outer conductor ony if the plating is required to meet environmental specifications. While plating is cosmetically pleasing and offers improvement in solderability, it has no functional use in terms of cable performance.
- Using specific connector brand only when it is an absolute requirement, thus avoiding procurement delays.

CABLE PRECONDITIONING

The electrical and mechanical performance of semi-rigid cable is achieved by a compression fit between the outer conductor and the dielectric core which, in turn, necessitates a manufacturing process causing core elongation. As a result, the core in semi-rigid cables is in mechanical tension which will tend to equalize with time and cause recession of the core dielectric from the cable ends. If this occurs in cable that has become part of a cable assembly, the resultant development of an air-void at the cable/connector interface causes SWR increase. It is therefore advantageous to induce core stress relief by preconditioning cable before it becomes a completed cable assembly.

Since preconditioning is not effective on long lengths of cable, and bending of cable reintroduces core stresses, preconditioning should be performed as part of a cable assembly manufacturing process in the following order:

1. Cut developed length of cable allowing for an extra 1/4" (6.35mm) on each end, to accommodate the dielectric recess incurred in preconditioning.
2. Perform bending operations.
3. Precondition by performing two or more of the following temperature cycle steps:

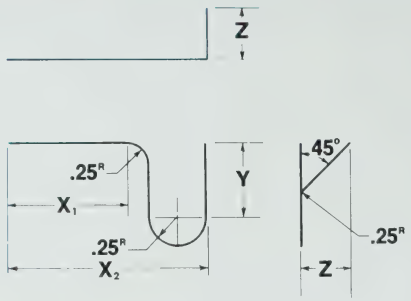
Step A: Heat cable to T_o, the maximum operating temperature specified on pages 6 to 13 in this bulletin, and maintain for one hour minimum.

Step B: Return cable to room temperature. Trim protruding teflon, if any, flush with the edge of the outer conductor.

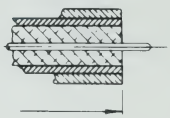
Step C: Maintain cable at room temperature for one hour minimum.

After completion of temperature cycling, maintain cable at room temperature for at least 24 hours before proceeding with further processing.

4. Make final length cut and prepare ends.
5. Install connectors if required.



Note:
SMA connector-cable interface



Dimension to cable center line in all cases is necessary, and from cable interface with connector where practical. Detail connector if interface dimension is not given.

Center Line Layout Technique.

MANUFACTURING OPERATIONS

At Micro-Coax Components the manufacture of Micro-Coax Cable and Cable Assemblies is fast, precise and efficient. It is based on the use of sophisticated production equipment. Some of these operations are discussed below.

SINKING

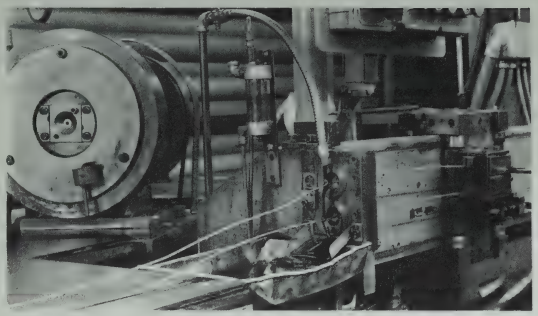
In this operation tubular outer conductor is reduced by a sinking process to accomplish the finished cable size and achieve the proper "fit" to the dielectric. Micro-Coax in lengths up to 40 ft. (12.19m) is manufactured on a specially designed bench in straight, rather than coiled sections, with the following advantages:

Sinking applies force only along the axis of the cable and imparts no "set" to the center or outer conductors as would be the case if the cable were made in coils.

Sinking minimizes subsequent straightening operations and related work-hardening of the conductors.

Sinking allows bending of finished cable in any plane with uniform springback.

Sinking improves impedance control.

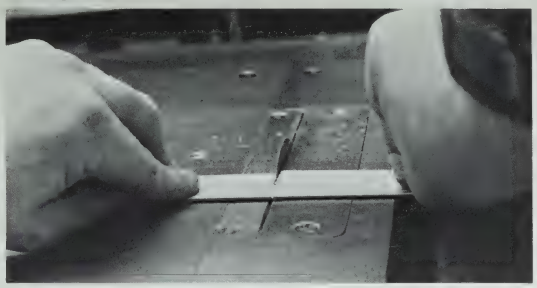


Sinking operation.

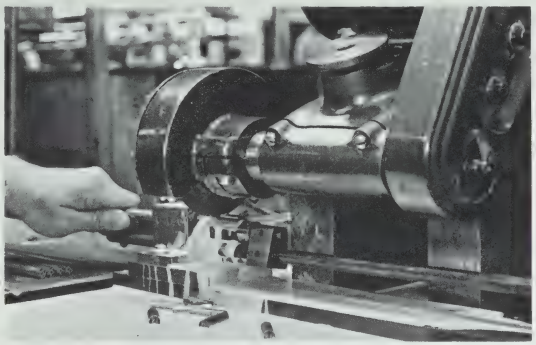
CUTTING

Micro-Coax Cable is easily cut. Prototype cutting can be done with any table saw. Burrs are removed in subsequent stripping and finishing operations. In saw cutting of cable sizes 0.085" (2.16mm) diameter or larger, Micro-Coax Components obtains excellent results using a table saw equipped with a carbide blade.

During high production saw cutting, Micro-Coax Components utilizes guide assemblies for the material, and adjustable stops to maintain accurate length.



Prototype cutting or random straight length cutting.



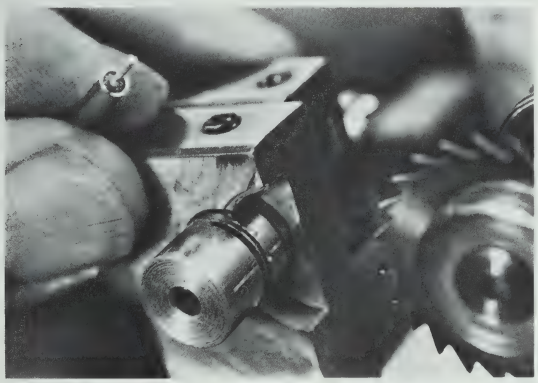
High speed saw cutting.

SCORE CUTTING

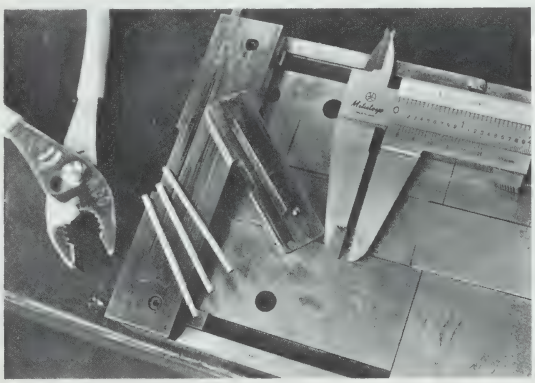
The score cutting technique is used on cables up to 0.141" (3.58mm) diameter. Using a sharp-edged blade, the cable material is scored approximately one-half the thickness of the outer conductor. When flexed the tubing breaks at the score mark. The dielectric is then blade-cut and stripped from the center conductor.

STRIPPING

To strip cable of jacket, only score cutting can be utilized. If jacket and Teflon are to be stripped at the same time, special saw techniques can be used to accomplish a precise cut.



Stripping operation.



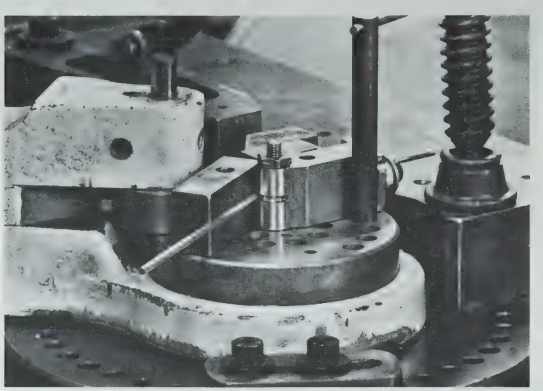
Score cutting of Micro-Coax Cable.

MANUFACTURING OPERATIONS

BENDING

In large radius bends (ten times the cable diameter or larger), the use of simple tooling, such as posts or dowels, is adequate. For smaller radius bends, some grooving of the bend tools is required to prevent flattening of the cable at the point of bend. Following is the recommended procedure.

- Groove the radius block, clamp block and follower block. Groove should be slightly larger than the outside diameter of the cable, for example, 0.143" (3.63mm) for Micro-Coax UT 141A which has an outside diameter of 0.141" (3.58mm) ±0.001" (0.0254mm).
- Clamp the cable in position.
- Move the follower block so that it maintains continuous contact with the radius block at the point of bend. This can be assured by an arm located off of the center of the fixture with a roller positioned behind the follower block.
- Bend slowly, evenly, and continuously until the angle of the bend is achieved.
- Should wrinkles develop on the inside radius of the outer conductor material, increase the pressure on the follower block. If a "blister" develops on the outer conductor, decrease the pressure.

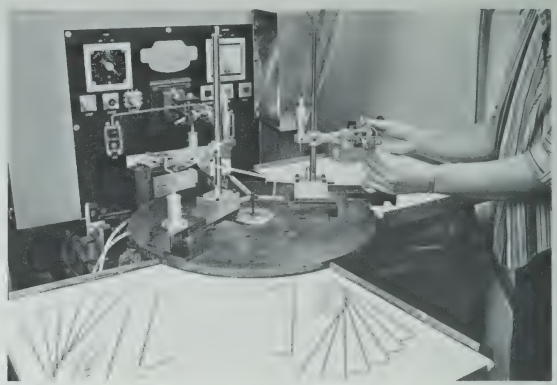


Typical bend set-up for 0.141"D cable employing a grooved radius block, clamp block, and follower block.

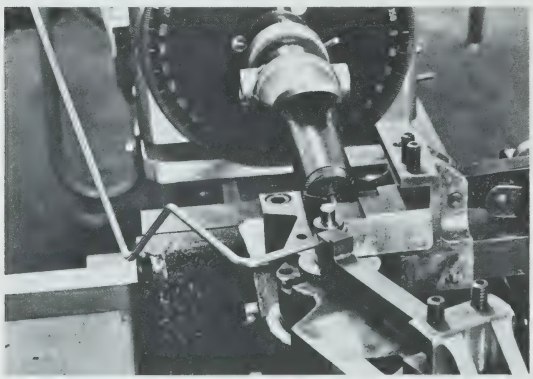
SOLDERING

Soldering of Micro-Coax Cable requires skill. Heat must be applied for the shortest possible time to the area of greatest mass in the interconnection to avoid dielectric expansion. Resistance or induction soldering techniques in many instances produce a far superior joint and fillet than the conventional soldering iron. Following is the recommended procedure:

- Preclean all connectors and formed cables.
- Use uncontaminated resin flux. One drop is adequate.
- Use resin core solder. Make a preform by helically wrapping solder on a scrap piece of coax and slicing this with a razor blade.
- Keep the heat exposure time to an absolute minimum to avoid dielectric expansion.
- Heat sink the connector body while soldering to conduct heat away from the connection.
- Clean off flux residue after removal of heat using 99% pure isopropyl alcohol. Let stand prior to trimming.
- Before trimming, push expanded dielectric back with a hollow pin. Otherwise a void will develop at the end of the cable when the dielectric is trimmed.



Application of induction soldering technique.



Precision high production bending operation. Cable can be bent in virtually any plane.

Soldering under microscope.

Micro-Coax Components test facilities provide certification of compliance with the most demanding specifications. Primary and secondary standards are maintained with full traceability to the National Bureau of Standards.

GENERAL TESTING PROCEDURE

Electrical and electronic tests range from the basic measurement of impedance, insulation resistance and capacitance of the basic cable to complex performance specifications including SWR, attenuation, and phase matching. Tests can be performed under controlled laboratory conditions duplicating unusual environmental temperatures and atmospheres, or under actual service conditions. Both single and swept frequency coverage are available up to 40 GHz.

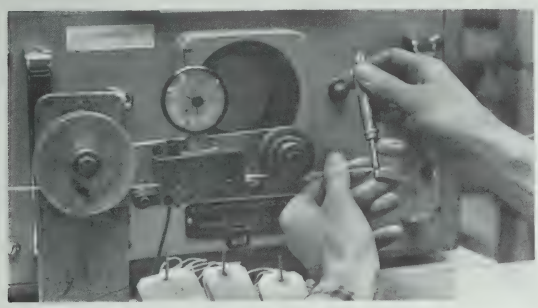
Metallurgical, chemical, and physical tests developed by Micro-Coax Components for use in our sophisticated tube mill are available to verify material purity, strength, malleability, surface finish, and integrity of interconnection.

Non-destructive testing is available to verify defect level of every element of the cable using ultrasonic, eddy current, and dye penetrant test procedures.

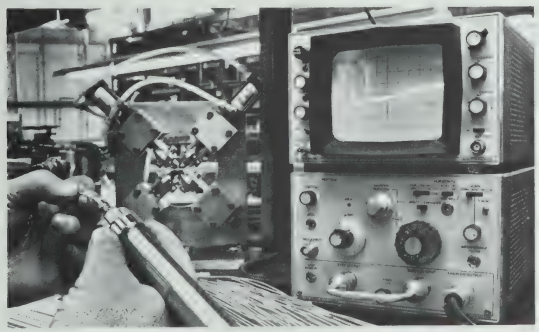
CORE TESTING

The first step in assuring proper cable manufacture is the testing of the core which includes the center conductor and the dielectric. For this reason, Micro-Coax Components inspects all cores for concentricity of the center conductor within the dielectric, and compliance with dielectric diameter specifications on a 100% level.

This insures proper mating of SMA connectors, proper cable/connector interface, uniform characteristic impedance throughout the entire cable length, proper adhesion between conductors and dielectric, high voltage (corona) performance.



Core testing



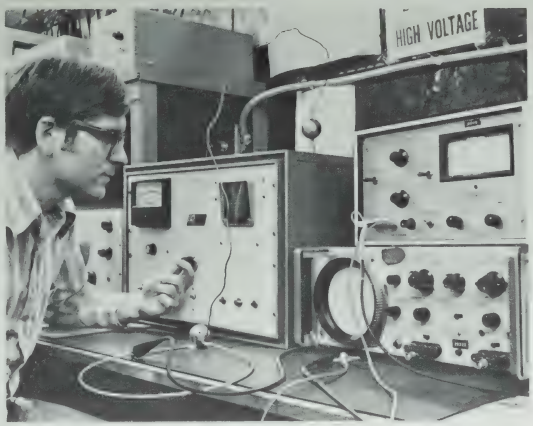
Cable impedance testing with time domain reflectometry

TIME DOMAIN REFLECTOMETRY TEST

Time Domain Reflectometry (TDR) is employed to measure impedance and group delay. Calibrated secondary standards provide for accurate measurement of impedance within 0.1 ohm on 50 ohm cables, and 0.3 ohms on 75 ohm cables; and of delays within 0.1 nanosecond.

CORONA AND INSULATION RESISTANCE TEST

Micro-Coax Components equipment is capable of measuring 5 picocoulomb discharges at 60 Hz test potentials up to 25 kV and insulation resistance up to 2X 10^6 megohms at 1000 VDC.



Corona test set-up for UT 141A cable at 1900 VRMS, 60 hertz, corona extinction

PHASE MATCHING TEST

Micro-Coax Components has the capability to phase match cable assemblies up to 18 GHz. For one particular application, Micro-Coax Components phase matched 8,000 assemblies at 5.0 GHz to a tolerance of ±2°.

Automatic Network Analyzer gives accurate data on amplitude and phase measurement of complete Micro-Coax Cable Assemblies. This permits Micro-Coax Components to offer phase and amplitude matched sets of cable assemblies.

SECTION 3
CONNECTORS FOR SEMI-RIGID CABLE
MICRO-COAX CONNECTORS FOR SEMI-RIGID CABLES

Eleven connectors for semi-rigid cables manufactured by Micro-Coax Components, Inc., have received MIL-Spec approval. Connectors for both 0.085" (2.16mm) diameter cable and 0.141" (3.58mm) diameter cable can be supplied. Connectors to accommodate short and long ferrule lengths can be provided.

Government Designation	Micro-Coax Part Number	Coax Outer Diameter (inches/mm)	Figure Number	Safety Wire Hole	Remarks
M39012/79-3001	11 SMA-50-2-203	0.085/2.16	1	Yes	With pin and insulator
M39012/79-3001	11 SMA-50-2-215	0.085/2.16	2	Yes	With pin and insulator
M39012/79-3101	11 SMA-50-2-202	0.085/2.16	1	No	With pin and insulator
M39012/79-3101	11 SMA-50-2-201	0.085/2.16	2	No	With pin and insulator
M39012/79-3002	11 SMA-50-3-207	0.141/3.58	1	Yes	With pin and insulator
M39012/79-3102	11 SMA-50-3-201	0.141/3.58	1	No	With pin and insulator
M39012/92-3001	11 SMA-50-3-206	0.141/3.58	1	Yes	Without pin and insulator
M39012/92-3001	11 SMA-50-3-206/111	0.141/3.58	1	Yes	Without pin and insulator (1)
M39012/92-3001	11 SMA-50-3-222	0.141/3.58	2	Yes	Without pin and insulator
M39012/92-3101	11 SMA-50-3-202	0.141/3.58	1	No	Without pin and insulator
M39012-92-3101	11 SMA-50-3-203	0.141/3.58	2	No	Without pin and insulator

(1) Gold-plated coupling nut, may be dropped from QPL by 31 December 1985

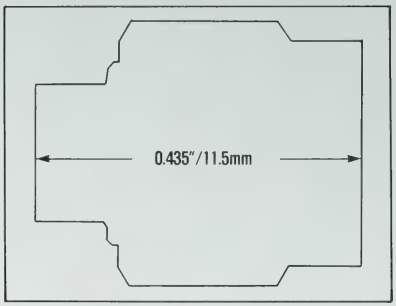


Figure 1

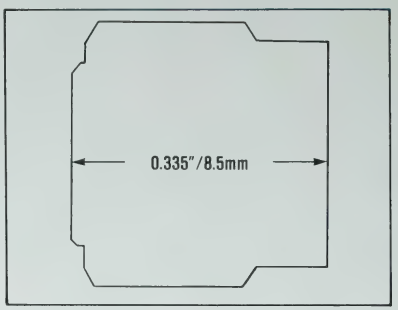


Figure 2

HUBER + SUHNER CONNECTORS FOR SEMI-RIGID CABLE

Suitable Connectors for Various Cables — Connector Group A	B	C	D	E	F	G	H	I	K	L	M	N	O	Cable Type	Impedance (ohms)	Center Conductor Diameter (inches/mm)	Center Conductor Material	Dielectric Diameter (inches/mm)	Outer Conductor Diameter (inches/mm)	Outer Conductor Material	Remarks
•														UT†† 34	50	0.008/0.20	SPCW	0.026/0.66	0.034/0.86	Cu	
•														UT 34-TP	50	0.008/0.20	SPCW	0.026/0.66	0.035/0.88	Cu*	
•														UT 34-SP	50	0.008/0.20	SPCW	0.026/0.66	0.035/0.88	SPC	
•														UT 34-M17	50	0.008/0.20	SPCW	0.026/0.66	0.034/0.86	Cu	MIL QPL
•														UT 34-TP-M17	50	0.008/0.20	SPCW	0.026/0.66	0.034/0.86	Cu*	MIL QPL
	•													UT 47	50	0.0113/0.29	SPCW	0.037/0.94	0.047/1.19	Cu	
	•													UT 47-TP	50	0.0113/0.29	SPCW	0.037/0.94	0.048/1.21	Cu*	
	•													UT 47-SP	50	0.0113/0.29	SPCW	0.037/0.94	0.048/1.21	SPC	
	•													UT 47-M17	50	0.0113/0.29	SPCW	0.037/0.94	0.047/1.19	Cu	MIL QPL
	•													UT 47-TP-M17	50	0.0113/0.29	SPCW	0.037/0.94	0.048/1.21	Cu*	MIL QPL
		•												UT 85	50	0.0201/0.51	SPCW	0.066/1.68	0.0865/2.20	Cu	
		•												UT 85-TP	50	0.0201/0.51	SPCW	0.066/1.68	0.0874/2.22	Cu*	
		•												UT 85-SP	50	0.0201/0.51	SPCW	0.066/1.68	0.0874/2.22	SPC	
		•												UT 85	50	0.0201/0.51	SPC	0.066/1.68	0.0865/2.20	Cu	
		•												UT 85C-TP	50	0.0201/0.51	SPC	0.066/1.68	0.0874/2.22	Cu*	
		•												UT 85C-SP	50	0.0201/0.51	SPC	0.066/1.68	0.0874/2.22	SPC	
		•												UT 85-M17	50	0.0201/0.51	SPCW	0.066/1.68	0.0865/2.20	Cu	MIL QPL
		•												UT 85-TP-M17	50	0.0201/0.51	SPCW	0.066/1.68	0.0874/2.22	Cu*	MIL QPL
		•												UT 85C-M17	50	0.0201/0.51	SPC	0.066/1.68	0.0865/2.20	Cu	MIL QPL
		•												UT 85C-TP-M17	50	0.0201/0.51	SPC	0.066/1.68	0.0874/2.22	Cu*	MIL QPL
		•												UT 85 Type	50	0.0201/0.51	SPCW	0.066/1.68	0.0865/2.20	Cu	
			•											UT 85-75	75	0.0113/0.29	SPCW	0.067/1.70	0.085/2.16	Cu	
			•											UT 85-75-TP	75	0.0113/0.29	SPCW	0.067/1.70	0.0858/2.18	Cu*	
				•										UT 141A	50	0.0359/0.91	SPCW	0.1175/2.98	0.141/3.58	Cu	
				•										UT 141AA	50	0.0359/0.91	SPCW	0.1175/2.98	0.141/3.58	Cu	
				•										UT 141A-TP	50	0.0359/0.91	SPCW	0.1175/2.98	0.142/3.60	Cu*	
				•										UT 141A-SP	50	0.0359/0.91	SPCW	0.1175/2.98	0.142/3.60	SPC	
				•										UT 141A-Type	50	0.0359/0.91	SPCW	0.1175/2.98	0.141/3.58	Cu	
				•										UT 141SA	50	0.0359/0.91	SPCW	0.1175/2.98	0.141/3.58	Cu	
				•										UT 141-B	50	0.0359/0.91	SP BeCu	0.1175/2.98	0.141/3.58	Cu	
				•										UT 141-C	50	0.0359/0.91	SPC	0.1175/2.98	0.141/3.58	Cu	
				•										UT 141-C-TP	50	0.0359/0.91	SPC	0.1175/2.98	0.142/3.60	Cu*	
				•										UT 141-C-SP	50	0.0359/0.91	SPC	0.1175/2.98	0.142/3.60	SPC	
				•										UT 141SA-M17	50	0.0362/0.92	SPCW	0.1175/2.98	0.141/3.58	Cu	MIL QPL
				•										UT 141SA-TP-M17	50	0.0362/0.92	SPCW	0.1175/2.98	0.142/3.60	Cu*	MIL QPL
					•									UT 141-75	75	0.0201/0.51	SPCW	0.1175/2.98	0.141/3.58	Cu	
					•									UT 141-75-TP	75	0.0201/0.51	SPCW	0.1175/2.98	0.142/3.58	Cu*	
						•								UT 250A	50	0.0640/1.63	SPC	0.209/5.31	0.250/6.35	Cu	
						•								UT 250A Type	50	0.0640/1.63	SPC	0.209/5.31	0.250/6.35	Cu	
						•								UT 250A-TP	50	0.0640/1.63	SPC	0.209/5.31	0.251/6.37	Cu*	
						•								UT 250A-SP	50	0.0640/1.63	SPC	0.209/5.31	0.251/6.37	SPC	
						•								UT 250A-AL	50	0.0640/1.63	SPC	0.209/5.31	0.250/6.35	AL	
						•								UT 250A-M17	50	0.0640/1.63	SPC	0.209/5.31	0.250/6.35	Cu	MIL QPL
						•								UT 250A-TP-M17	50	0.0640/1.63	SPC	0.209/5.31	0.251/6.37	Cu*	MIL QPL
							•							UT 325A	50	7 x 0.0312/7 x 0.79	SPC	0.285/7.24	0.325/8.26	Cu	
								•						UT 390	50	0.102/2.59	SPC	0.332/8.43	0.390/9.91	Cu	
									•					UT S-250	50	0.087/2.21	Cu	0.221/5.61 (3)	0.250/6.35	Cu	0.066/1.68 ‡
										•				UT S-325	50	0.110/2.79	Cu	0.285/7.24 (5)	0.325/8.26	Cu	0.090/2.29 ‡
											•			UT S-375	50	0.126/3.20	Cu	0.325/8.26 (5)	0.375/9.53	Cu	0.085/2.16 ‡
												•		UT S-390	50	0.136/3.45	Cu	0.340/8.64 (5)	0.390/9.91	Cu	0.096/2.44 ‡
													•	UT S-500	50	0.174/4.42	Cu	0.450/11.43 (5)	0.500/12.7	Cu	0.134/3.40 ‡

Cu: Copper Cu*: Tin-plated copper SPC: Silver-plated copper SPCW: Silver-plated, copper-clad steel SPBeCu: Silver-plated beryllium copper AL: Aluminum
(3): 3 spline (5): 5 spline ‡: Center conductor ID

†† Registered trademark of UTI Corporation

ASSEMBLY TOOLS

Assembly Procedure	Recommended Tool	Assembly Procedure	Recommended Tool	Assembly Procedure	Recommended Tool
MAP 36 3064	74 Z-0-0-29 74 Z-0-0-70	9006 9055	74 Z-0-0-71 74 Z-0-0-70	9119	74 Z-0-0-116 + 74 Z-0-0-14 + 74 Z-0-0-115
3066	74 Z-0-0-70	9056	74 Z-0-0-70	9123	74 Z-0-0-71
3068 3095	74 Z-0-0-70 74 Z-0-0-71	9057 9073	74 Z-0-0-70 —	9124	74 Z-0-0-71 + 74 Z-0-2-6
3100 9000	— 74 Z-0-0-30	9089	74 Z-0-0-85 + 74 Z-0-0-83 (UT 250) + 74 Z-0-0-112 (UT 390)	9125	74 Z-0-0-84 + 74 Z-0-0-85 + 74 Z-0-0-113
9001	—	9100	74 Z-0-0-70	9127	74 Z-0-0-17
9002 9003 9005	— — 74 Z-0-0-71	9106 9118	74 Z-0-0-70 74 Z-0-0-116 + 74 Z-0-0-14 + 74 Z-0-0-115	9129	74 Z-0-0-119 or 74 Z-0-0-120 or 74 Z-0-0-121 or 74 Z-0-0-122

CONNECTORS FOR GROUP A SMA CONNECTORS UT 34 CABLE 18 GHz

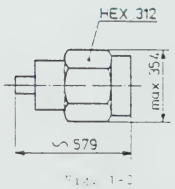
Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 SMA-50-1-1c	Soldered	Soldered	Beryllium copper	Gold	1-2	—	9118
Cable jack	21 SMA-50-1-1c	Soldered	Soldered	Beryllium copper	Gold	2-2	—	9118
Panel jack	25 SMA-50-1-1c	Soldered	Soldered	Beryllium copper	Gold	3-2	Square flange	9118
Panel jack	25 SMA-50-1-3c	Soldered	Soldered	Beryllium copper	Gold	4-2	Narrow flange	9118

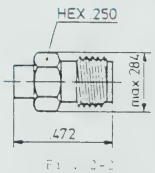
CONNECTORS FOR GROUP B MCX CONNECTORS UT 47 CABLE 3 GHz

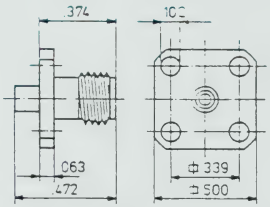
Straight cable plug	11 MCX-50-1-3	Soldered	Soldered	Brass	Gold	1-3		3100
Right angle plug	16 MCX-50-1-3c	Soldered	Soldered	Brass	Gold	2-3	—	9000
Cable jack	21 MCX-50-1-3	Soldered	Soldered	Brass	Gold	3-3	—	3100
Panel jack	24 MCX-50-1-3	Soldered	Soldered	Brass	Gold	4-3	—	3100
Panel jack	24 MCX-50-1-4	Soldered	Soldered	Brass	Gold	5-3	—	3100
PC-Board cable termination	83 MCX-0-1-1		Soldered	Brass	Gold	6-3	Cable feed-through	9001

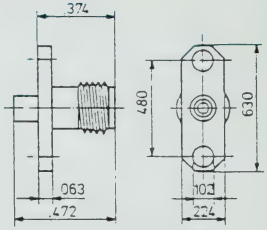
CONNECTORS FOR GROUP B SMA CONNECTORS UT 47 CABLE 18 GHz

Straight cable plug	11 SMA-50-1-2c	Soldered	Soldered	Beryllium copper	Gold	1-2		9119
Cable jack	21 SMA-50-1-2c	Soldered	Soldered	Beryllium copper	Gold	2-2	—	9119
Panel jack	25 SMA-50-1-2c	Soldered	Soldered	Beryllium copper	Gold	3-2	Square flange	9119
Panel jack	25 SMA-50-1-4c	Soldered	Soldered	Beryllium copper	Gold	4-2	Narrow flange	9119









CONNECTORS FOR GROUP C MCX CONNECTORS UT 85 CABLE 3 GHz

Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 MCX-50-2-3	Soldered	Soldered	Brass	Gold	1-3	—	3100
Right angle plug	16 MCX-50-2-3c	Soldered	Soldered	Brass	Gold	2-3	—	9000
Cable jack	21 MCX-50-2-3	Soldered	Soldered	Brass	Gold	3-3	—	3100
Panel jack	24 MCX-50-2-3	Soldered	Soldered	Brass	Gold	4-3	—	3100
Panel jack	24 MCX-50-2-4	Soldered	Soldered	Brass	Gold	5-3	Front mounting	3100
PC-board cable termination	83 MCX-0-2-1	Soldered	Soldered	Brass	Gold	6-3	Cable feed-through	9001

CONNECTORS FOR GROUP C SMB CONNECTORS UT 85 CABLE 3 GHz

Straight cable plug	11 SMB-50-2-13c	Soldered	Soldered	Brass	Gold	7-3	—	9002
Right angle plug	16 SMB-50-2-13c	Soldered	Soldered	Brass	Gold	8-3	—	9003
Cable jack	21 SMB-50-2-13c	Soldered	Soldered	Brass	Gold	9-3	—	9002
Panel jack	24 SMB-50-2-13c	Soldered	Soldered	Brass	Gold	10-3	—	9002

CONNECTORS FOR GROUP C SMC CONNECTORS UT 85 CABLE 10 GHz

Straight cable plug	11 SMC-50-2-13c	Soldered	Soldered	Brass	Gold	11-3	—	9002
Right angle plug	16 SMC-50-2-13c	Soldered	Soldered	Brass	Gold	12-3	—	9003
Cable jack	21 SMC-50-2-13c	Soldered	Soldered	Brass	Gold	13-3	—	9002
Panel jack	24 SMC-50-2-13c	Soldered	Soldered	Brass	Gold	14-3	—	9002

CONNECTORS FOR GROUP C SMS CONNECTORS UT 85 CABLE 3 GHz

Straight cable plug	11 SMS-50-2-13c	Soldered	Soldered	Brass	Gold	15-3	—	9002
Right angle plug	16 SMS-50-2-13c	Soldered	Soldered	Brass	Gold	16-3	—	9003
Panel jack	24 SMS-50-2-13c	Soldered	Soldered	Brass	Gold	17-3	—	9002

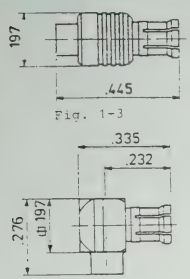


Fig. 1-3

Fig. 2-3

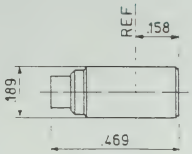


Fig. 3-3

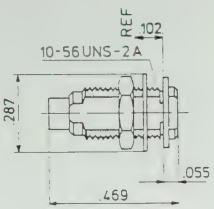


Fig. 4-3

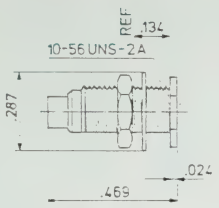


Fig. 5-3

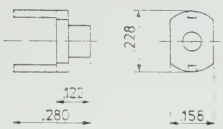


Fig. 6-3

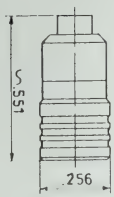


Fig. 7-3

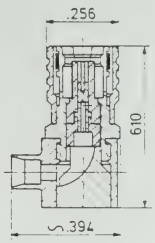


Fig. 8-3

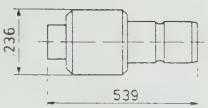


Fig. 9-3

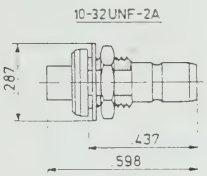


Fig. 10-3

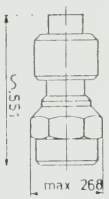


Fig. 11-3

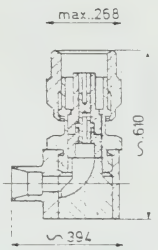


Fig. 12-3

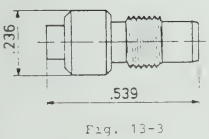


Fig. 13-3

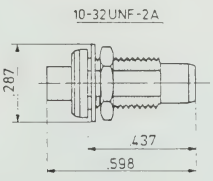


Fig. 14-3

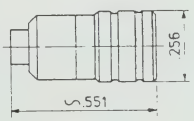


Fig. 15-3

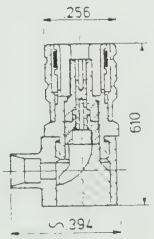


Fig. 16-3

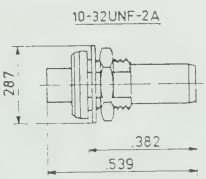


Fig. 17-3

CONNECTORS FOR GROUP C SMA CONNECTORS UT 85 CABLE 18 GHz

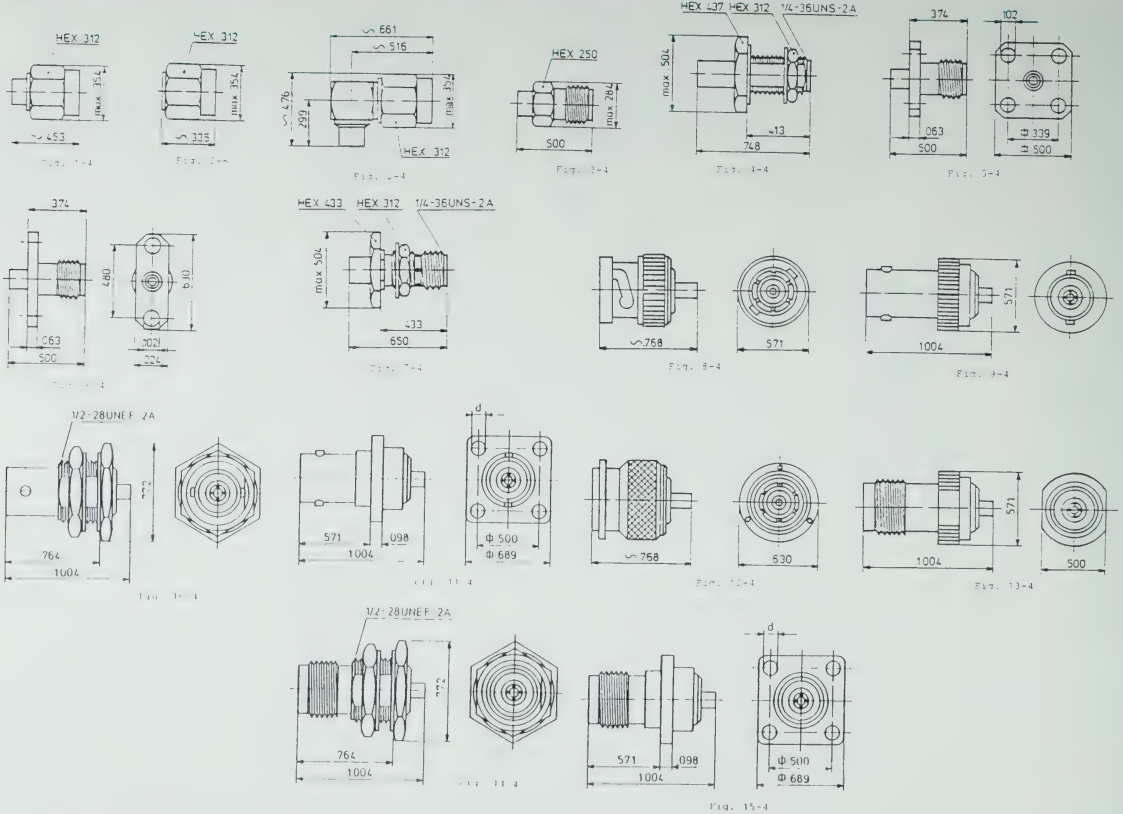
Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 SMA-50-2-301	Soldered	Soldered	Stainless steel	Passivated	2-6	Gold ferrule	9114
Straight cable plug	11 SMA-50-2-302	Soldered	Soldered	Stainless Steel	Passivated	1-4	Gold ferrule	9114
Straight cable plug	11 SMA-50-2-15	Soldered	Soldered	Beryllium copper	Gold	1-4	—	9056
Right angle plug	16 SMA-50-2-3c	Soldered	Soldered	Beryllium copper	Gold	2-4	Up to 12.4 GHz	3068
Cable jack	21 SMA-50-2-15	Soldered	Soldered	Beryllium copper	Gold	3-4	—	9057
Panel jack	24 SMA-50-2-15	Soldered	Soldered	Beryllium copper	Gold	4-4	—	9057
Panel jack	25 SMA-50-2-15	Soldered	Soldered	Beryllium copper	Gold	5-4	Square flange	9057
Panel jack	25 SMA-50-2-25	Soldered	Soldered	Beryllium copper	Gold	6-4	Narrow flange	9057
Straight cable plug	11 SMA-50-2-65	Soldered	Soldered	Stainless steel	Passivated	1-4	Cable entry: Gold	9056
Panel jack	24 SMA-50-2-41	Soldered	Soldered	Brass	Sucoplate	7-4	—	3066

CONNECTORS FOR GROUP C BNC CONNECTORS UT 85 CABLE 4 GHz

Straight cable plug	11 BNC-50-2-20	Soldered	Soldered	Brass	Sucoplate	8-4	—	9100
Cable jack	21 BNC-50-2-20	Soldered	Soldered	Brass	Sucoplate	9-4	—	9100
Panel jack	24 BNC-50-2-20	Soldered	Soldered	Brass	Sucoplate	10-4	—	9100
Panel jack	25 BNC-50-2-20	Soldered	Soldered	Brass	Sucoplate	11-4	With threads 3-56 UNF	9100
Panel jack	25 BNC-50-2-21	Soldered	Soldered	Brass	Sucoplate	11-4	With fastening holes	9100

CONNECTORS FOR GROUP C TNC CONNECTORS UT 85 CABLE 11 GHz

Straight cable plug	11 TNC-50-2-20	Soldered	Soldered	Brass	Sucoplate	12-4	—	9100
Cable jack	21 TNC-50-2-20	Soldered	Soldered	Brass	Sucoplate	13-4	—	9100
Panel jack	24 TNC-50-2-20	Soldered	Soldered	Brass	Sucoplate	14-4	—	9100
Panel jack	25 TNC-50-2-20	Soldered	Soldered	Brass	Sucoplate	15-4	With threads 3-56 UNF	9100
Panel jack	25 TNC-50-2-21	Soldered	Soldered	Brass	Sucoplate	15-4	With fastening holes	9100



CONNECTORS FOR GROUP C TNC CONNECTORS UT 85 CABLE 16 GHz

Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 TNC-50-2-12	Soldered	Soldered	Brass	Sucoplate	1-5	—	9124
Cable jack	21 TNC-50-2-12	Soldered	Soldered	Brass	Sucoplate	2-5	—	9124

CONNECTORS FOR GROUP C N CONNECTORS UT 85 CABLE 18 GHz

Straight cable plug	11 N-50-2-14	Soldered	Soldered	Brass	Sucoplate	3-5	—	9130
Cable jack	21 N-50-2-14	Soldered	Soldered	Brass	Sucoplate	4-5	—	9073
Panel jack	24 N-50-2-14	Soldered	Soldered	Brass	Sucoplate	5-5	—	9073
Panel jack	25 N-50-2-14	Soldered	Soldered	Brass	Sucoplate	6-5	—	9073

CONNECTORS FOR GROUP D BNC CONNECTORS UT 85-75 CABLE 1 GHz

Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 BNC-75-2-16	Soldered	Soldered	Brass	Sucoplate	7-5	—	9100
Cable jack	21 BNC-75-2-6	Soldered	Soldered	Brass	Sucoplate	8-5	—	9100
Panel jack	24 BNC-75-2-7	Soldered	Soldered	Brass	Sucoplate	9-5	—	9100
Panel jack	25 BNC-75-2-9	Soldered	Soldered	Brass	Sucoplate	10-5	With threads 3-56 UNF	9100
Panel jack	25 BNC-75-2-10	Soldered	Soldered	Brass	Sucoplate	10-5	With fastening holes	9100

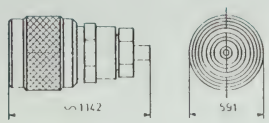


Fig. 1-5

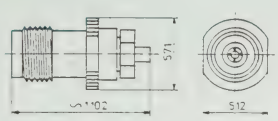


Fig. 2-5

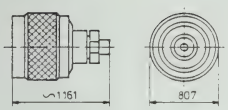


Fig. 3-5

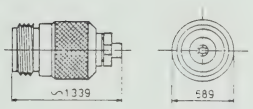


Fig. 4-5

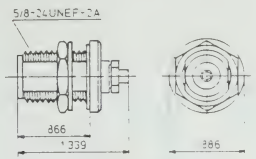


Fig. 5-5

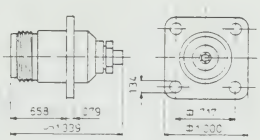


Fig. 6-5

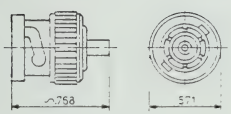


Fig. 7-5

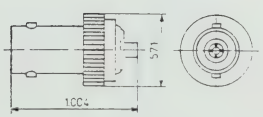


Fig. 8-5

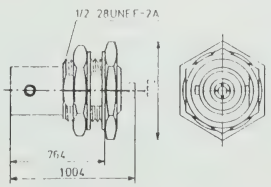


Fig. 9-5

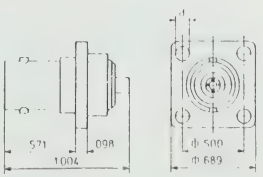


Fig. 10-5

CONNECTORS FOR GROUP E SMA CONNECTORS UT 141 CABLE 18 GHz

Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 SMA-50-3-301	Soldered	Soldered	Stainless steel	Passivated	1-6	Gold ferrule	9115
Straight cable plug	11 SMA-50-3-302	—	Soldered	Stainless steel	Passivated	1-6	Gold ferrule	9113
Straight cable plug	11 SMA-50-3-303	—	Soldered	Stainless steel	Passivated	2-6	Gold ferrule	9113
Straight cable plug	11 SMA-50-3-304	—	Soldered	Stainless steel	Passivated	1-6	Solder plated ferrule	9113
Straight cable plug	11 SMA-50-3-14	—	Soldered	Beryllium copper	Gold	1-6	Without pin + insulator	9055
Straight cable plug	11 SMA-50-3-15	Soldered	Soldered	Beryllium copper	Gold	1-6	—	9056
Straight cable plug	11 SMA-50-3-16	—	Soldered	Beryllium copper	Gold	2-6	Without pin + insulator	9055
Right angle plug	16 SMA-50-3-3c	Soldered	Soldered	Beryllium copper	Gold	3-6	to 12.4 GHz	3068
Cable jack	21 SMA-50-3-15	Soldered	Soldered	Beryllium copper	Gold	4-6	—	9057
Panel jack	24 SMA-50-3-15	Soldered	Soldered	Beryllium copper	Gold	5-6	—	9057
Panel jack	25 SMA-50-3-15	Soldered	Soldered	Beryllium copper	Gold	6-6	Square flange	9057
Panel jack	25 SMA-50-3-25	Soldered	Soldered	Beryllium copper	Gold	7-6	Narrow flange	9057
Straight cable plug	11 SMA-50-3-64	—	Soldered	Stainless steel	Passivated	1-6	Without pin + insulator	9055
Straight cable plug	11 SMA-50-3-65	Soldered	Soldered	Stainless steel	Passivated	1-6	—	9056
Straight cable plug	11 SMA-50-3-66	—	Soldered	Stainless steel	Passivated	2-6	Without pin + insulator	9055
Straight cable plug	11 SMA-50-3-41	Soldered	Soldered	Brass	Sucoplate	8-6	—	3064
Right angle plug	16 SMA-50-3-43c	Soldered	Soldered	Brass	Sucoplate	3-6	To 12.4 GHz	3068
Panel jack	24 SMA-50-3-41	Soldered	Soldered	Brass	Sucoplate	9-6	—	3066
Panel jack	25 SMA-50-3-43	Soldered	Soldered	Brass	Sucoplate	10-6	Square flange	3066

CONNECTORS FOR GROUP E Z CONNECTORS

Cable feed-through	71 Z-0-3-15	—	Soldered	Brass	Gold	11-6	Square flange	—
Cable feed-through	71 Z-0-3-16	—	Soldered	Brass	Gold	12-6	Square flange	—

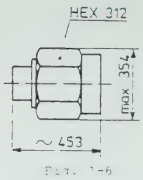


Fig. 1-6

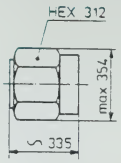


Fig. 2-6

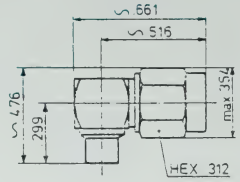


Fig. 3-6

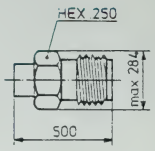


Fig. 4-6

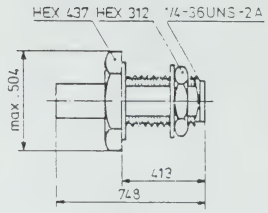


Fig. 5-6

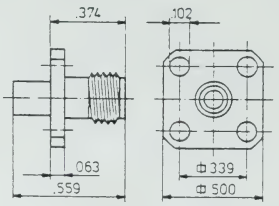


Fig. 6-6

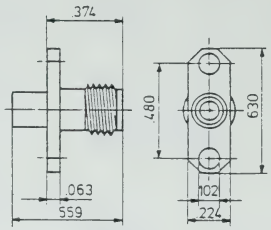


Fig. 7-6

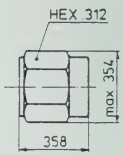


Fig. 8-6

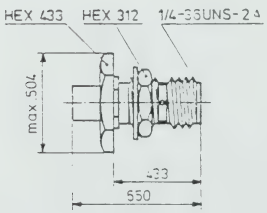


Fig. 9-6

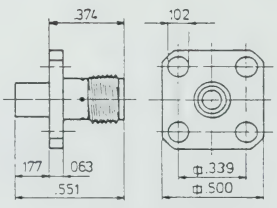


Fig. 10-6

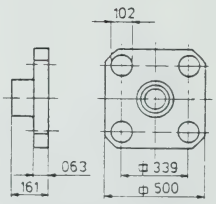


Fig. 11-6

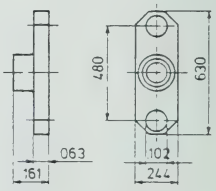


Fig. 12-6

CONNECTORS FOR GROUP E BNC CONNECTORS UT 141 CABLE 4 GHz

Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 BNC-50-3-54	Soldered	Soldered	Brass	Sucoplate	1-7	—	9106
Cable jack	21 BNC-50-3-33	Soldered	Soldered	Brass	Sucoplate	2-7	—	9005
Panel jack	24 BNC-50-3-33	Soldered	Soldered	Brass	Sucoplate	3-7	—	9005
Panel jack	25 BNC-50-3-33	Soldered	Soldered	Brass	Sucoplate	4-7	With threads 3-56 UNF	9005
Panel jack	25 BNC-50-3-34	Soldered	Soldered	Brass	Sucoplate	4-7	With fastening holes	9005

CONNECTORS FOR GROUP E TNC CONNECTORS UT 141 CABLE 11 GHz

Straight cable plug	11 TNC-50-3-29	Soldered	Soldered	Brass	Sucoplate	5-7	—	9106
Cable jack	21 TNC-50-3-29	Soldered	Soldered	Brass	Sucoplate	6-7	—	9005
Panel jack	24 TNC-50-3-29	Soldered	Soldered	Brass	Sucoplate	7-7	—	9005
Panel jack	25 TNC-50-3-29	Soldered	Soldered	Brass	Sucoplate	8-7	With threads 3-56 UNF	9005
Panel jack	25 TNC-50-3-30	Soldered	Soldered	Brass	Sucoplate	8-7	With fastening holes	9005
Straight cable plug	11 TNC-50-3-30	Soldered	Soldered	Brass	Sucoplate	9-7	To 16 GHz	9123
Cable jack	21 TNC-50-3-30	Soldered	Soldered	Brass	Sucoplate	10-7	To 16 GHz	9123

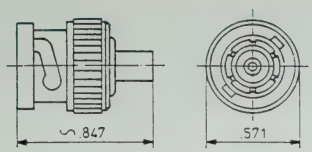


Fig. 1-7

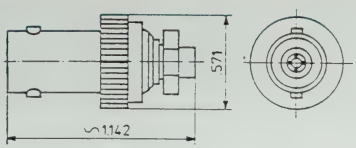


Fig. 2-7

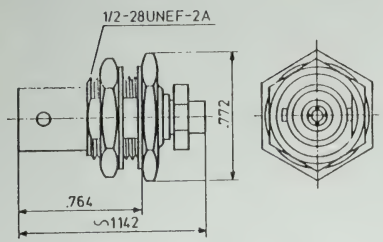


Fig. 3-7

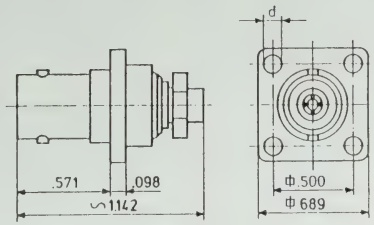


Fig. 4-7

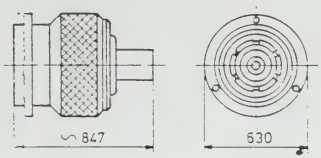


Fig. 5-7

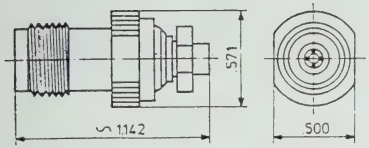


Fig. 6-7

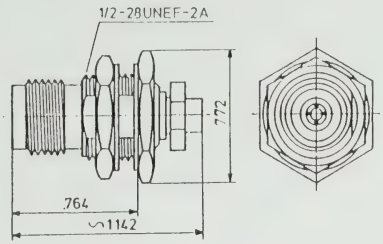


Fig. 7-7

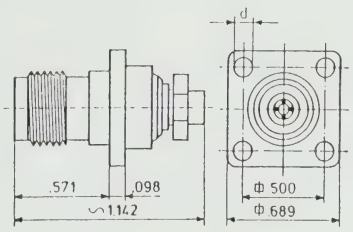


Fig. 8-7

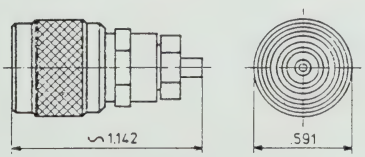


Fig. 9-7

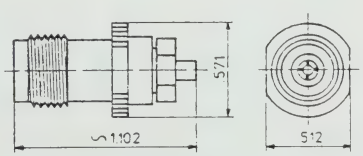


Fig. 10-7

CONNECTORS FOR GROUP E N CONNECTORS UT 141 CABLE 18 GHz

Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 N-50-3-13	Soldered	Soldered	Brass	Sucoplate	1-8	To 12.4 GHz	3095
Cable jack	21 N-50-3-11	Soldered	Soldered	Brass	Sucoplate	2-8	To 12.4 GHz	9005
Panel jack	24 N-50-3-14	Soldered	Soldered	Brass	Sucoplate	3-8	To 12.4 GHz	9005
Panel jack	25 N-50-3-9	Soldered	Soldered	Brass	Sucoplate	4-8	To 12.4 GHz	9005
Straight cable plug	11 N-50-3-51	Solderless	Soldered	Stainless steel	Passivated	5-8	Precision type	9006
Cable jack	21 N-50-3-51	Solderless	Soldered	Stainless steel	Passivated	6-8	Precision type	9006
Panel jack	24 N-50-3-51	Solderless	Soldered	Brass	Sucoplate	7-8	Precision type	9006

CONNECTORS FOR GROUP E PC7 CONNECTORS UT 141 CABLE 18 GHz

Straight cable plug	11 PC7-50-3-2	Solderless	Soldered	Brass	Gold	8-8	—	9006

CONNECTORS FOR GROUP F BNC CONNECTORS UT 141-75 CABLE 1 GHz

Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 BNC-75-3-26	Soldered	Soldered	Brass	Sucoplate	9-8	—	9106
Cable jack	21 BNC-75-3-10	Soldered	Soldered	Brass	Sucoplate	10-8	—	9005
Panel jack	24 BNC-75-3-11	Soldered	Soldered	Brass	Sucoplate	11-8	—	9005
Panel jack	25 BNC-75-3-20	Soldered	Soldered	Brass	Sucoplate	12-8	With threads 3-56 UNF	9005
Panel jack	25 BNC-75-3-21	Soldered	Soldered	Brass	Sucoplate	12-8	With fastening holes	9005

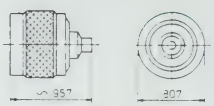


Fig. 1-8

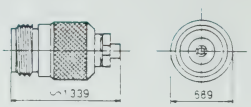


Fig. 2-8

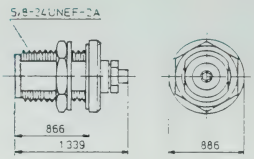


Fig. 3-8

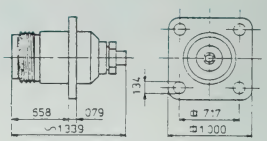
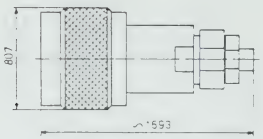


Fig. 4-8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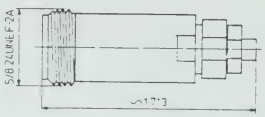
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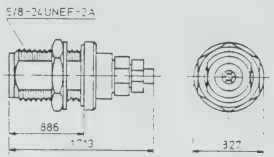


Fig. 7-8

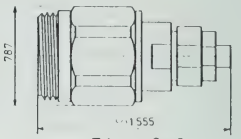


Fig. 8-8

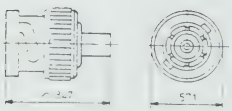


Fig. 9-8

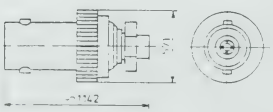


Fig. 10-8

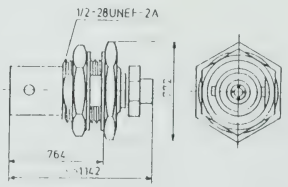


Fig. 11-8

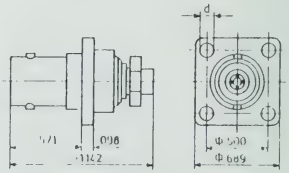


Fig. 12-8

CONNECTORS FOR GROUP G SMA CONNECTORS UT 250 CABLE 18 GHz

Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 SMA-50-5-1	Soldered	Soldered	Beryllium copper	Gold	1-9	—	9127
Cable jack	21 SMA-50-5-1	Soldered	Soldered	Beryllium copper	Gold	2-9	—	9127

CONNECTORS FOR GROUP G BNC CONNECTORS UT 250 CABLE 4 GHz

Straight cable plug	11 BNC-50-5-39c	Solderless	Clamped	Brass	Sucoplate	3-9	—	9089
Panel jack	24 BNC-50-5-39c	Solderless	Clamped	Brass	Sucoplate	4-9	—	9089

CONNECTORS FOR GROUP G TNC CONNECTORS UT 250 CABLE 16 GHz

Straight cable plug	11 TNC-50-5-39c	Solderless	Clamped	Brass	Sucoplate	5-9	—	9089
Panel jack	24 TNC-50-5-39c	Solderless	Clamped	Brass	Sucoplate	6-9	—	9089

CONNECTORS FOR GROUP G N CONNECTORS UT 250 CABLE 18 GHz

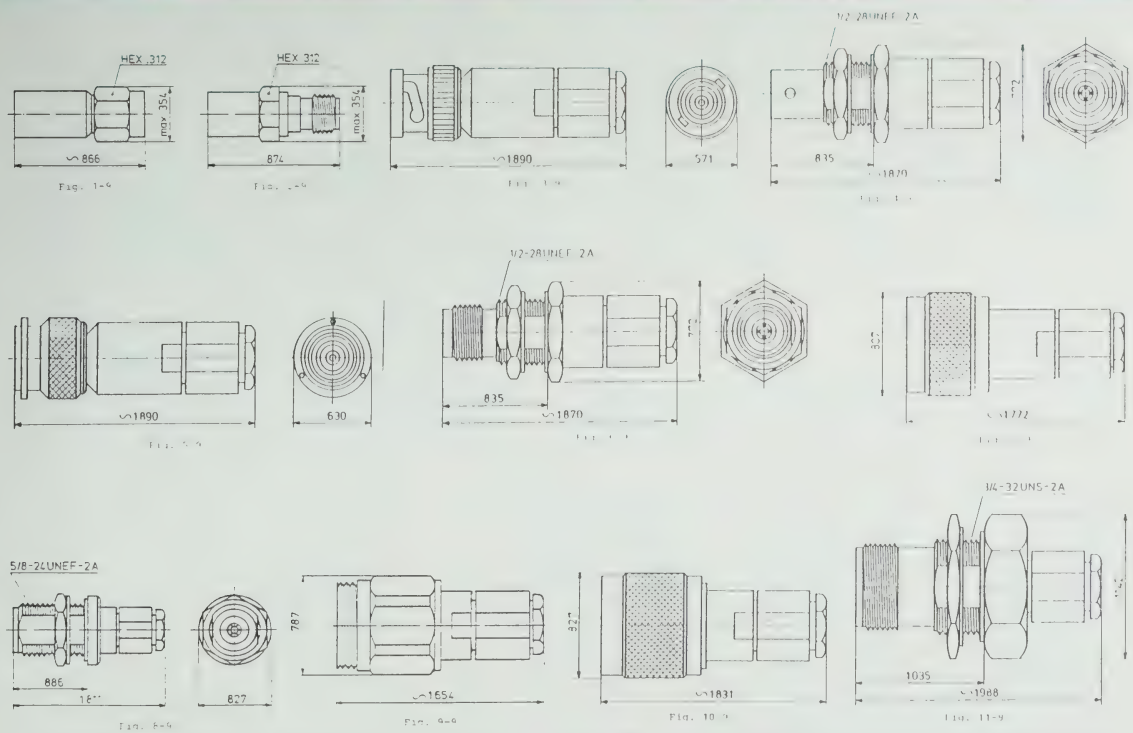
Straight cable plug	11 N-50-5-39c	Solderless	Clamped	Stainless steel	Passivated	7-9	—	9089
Panel jack	24 N-50-5-39c	Solderless	Clamped	Brass	Sucoplate	8-9	—	9089

CONNECTORS FOR GROUP G PC7 CONNECTORS UT 250 CABLE 18 GHz

Straight cable plug	11 PC7-50-5-1c	Solderless	Clamped	Brass	Gold	9-9	—	9089

CONNECTORS FOR GROUP G USC CONNECTORS UT 250 CABLE 12.4 GHz

Straight cable plug	11 USC-50-5-39c	Solderless	Clamped	Brass	Sucoplate	10-9	—	9089
Panel jack	24 USC-50-5-39c	Solderless	Clamped	Brass	Sucoplate	11-9	—	9089



CONNECTORS FOR GROUPS H and I

The connectors for both these groups consist of two individual parts: 1) the connector head which is determined by the required connector series; and 2) the cable entry which is determined by the cable being used. Both parts must be ordered. They can be assembled easily during cable mounting.

CONNECTORS FOR GROUPS H thru O TNC CONNECTOR HEADS UT 325 and UT 390 CABLES

Connector Description	Connector Part Number	Center Conductor	Outer Conductor	Material	Finish	Figure	Remarks	Assembly Procedure
Straight cable plug	11 TNC-50-7-4c			Brass	Sucoplate	1-10	Without cable entry	
Panel jack	24 TNC-50-7-1c			Brass	Sucoplate	2-10	Without cable entry	

CONNECTORS FOR GROUPS H thru O N CONNECTOR HEADS UT 325 and UT 390 CABLES

Straight cable plug	11 N-50-7-39c			Stainless steel	Passivated	3-10	Without cable entry	
Panel jack	24 N-50-7-21c			Brass	Sucoplate	4-10	Without cable entry	

CONNECTORS FOR GROUPS H thru O PC7 CONNECTOR HEAD UT 325 and UT 390 CABLES

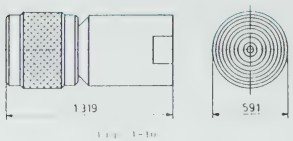
Straight cable plug	11 PC7-50-7-1c			Brass	Gold	5-10	Without cable entry	

CONNECTORS FOR GROUPS H thru O USC CONNECTOR HEADS UT 325 and UT 390 CABLES

Straight cable plug	11 USC-50-7-1c			Brass	Sucoplate	6-10	Without cable entry	
Panel jack	24 USC-50-7-1c			Brass	Sucoplate	7-10	Without cable entry	

CABLE ENTRIES FOR GROUPS H thru O CABLE ENTRIES

H UT 325A	71 Z-0-7-11	Solderless	Clamped	Brass	Sucoplate	8-10	To 14 GHz	9125
I UT 390	71 Z-0-8-1	Solderless	Clamped	Brass	Sucoplate	9-10	To 12 GHz	9089
K UT S-250-50	71 Z-0-6-1	Solderless	Soldered	Brass	Sucoplate	10-10	To 18 GHz	9129
L UT S-325-50	71 Z-0-7-12	Solderless	Soldered	Brass	Sucoplate	8-10	To 16.4 GHz	9129
M UT S-375-50	71 Z-0-8-2	Solderless	Soldered	Brass	Sucoplate	8-10	To 14.4 GHz	9129
N UT S-390-50	71 Z-0-9-1	Solderless	Soldered	Brass	Sucoplate	9-10	To 13.6 GHz	9129
O UT S-500-50	71 Z-0-11-1	Solderless	Soldered	Brass	Sucoplate	9-10	To 10.4 GHz	9129



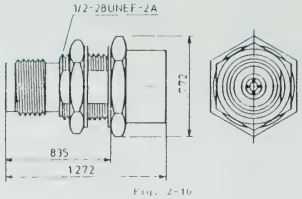


Fig. 2-10

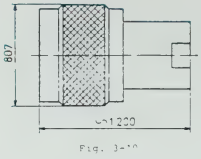


Fig. 3-10

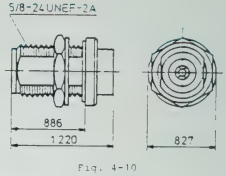


Fig. 4-10

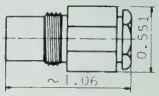
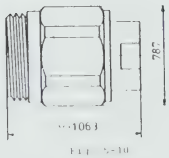
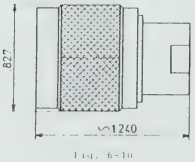
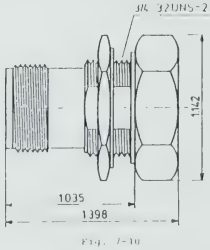
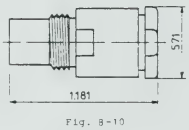


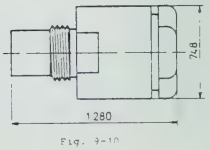
Fig. 10-10











OTHER HUBER + SUHNER PRODUCTS

Connectors and Adapters for Semi-Rigid and Flexible Cables

CONNECTORS IN STOCK 121 different connectors in series SMA, SMB, SMC, SMS, N, BNC, PC7, TNC, MCX, QLA

CUSTOM Complete line of hundreds of standard and special Micro-Coax and Suhner connectors

MIL-SPEC 13 Micro-Coax SMA connectors qualified to MIL-C-39012. 12 Suhner SMA connectors qualified to MIL-C-39012

ADAPTERS IN STOCK 73 different adapters between series SMA, SMB, SMC, SMS, N, BNC, PC7, TNC, MCX, QLA

CUSTOM Complete line of standard adapters

TOOLS IN STOCK 49 different tools for flexible and semi-rigid connector installation

SUCOFLEX Flexible Coaxial Microwave Cable Assemblies and Standard Flexible Coaxial Cables

SUCOFLEX CABLES IN STOCK 14 popular Sucoflex assemblies featuring the flexible cable that gives semi-rigid cable performance

CUSTOM Full line of Sucoflex 103, 104, and 106 cable assemblies made to order and supplied to specifications

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EMP and Lightning Protectors

CUSTOM Standard and special EMP protectors from DC through microwave frequencies. Available to meet most military and commercial applications. Type N and other connectors available.

"IN-A-CABLE" ATTENUATORS Attenuators integrated within semi-rigid cable for high performance, smaller size and weight and lower costs

Other Suhner Products

IN STOCK

27 different terminations, attenuators, detectors, and waveguide-to-coax adapters

CUSTOM

Full line of terminations, attenuators, detectors, and waveguide-to-coax adapters

Full line of quality Suhner low-pass, bandpass, and high-pass filters

Fiber optic cable and transmission systems

Micro-Coax Components, Inc., Box E, Collegeville, Pa. 19426, U.S.A. ☐ 215/489-3700

SECTION 4

MICRO-COAX "IN-A-CABLE" FILTERS *

Low-Pass, Bandpass, and High-Pass

As the persistent search for ever smaller components and more reliable performance in microwave transmission systems continues, the electrical concept of using distributed and lumped elements has been employed to integrate bandpass and low-pass filters **within** semi-rigid coaxial cables and cable assemblies. Micro-Coax Low-Pass, Bandpass, and High-Pass Filters "In-A-Cable" represent the development of an advanced technique for implanting the filter elements within a continuous section of miniature semi-rigid coaxial cable without sacrificing performance characteristics.

SUPERIOR FEATURES

Mechanical Advantages

- Considerably reduced space
- Significantly lower weight
- Withstands military environments

Performance Characteristics

- Higher over-all reliability
- Improved signal rejection
- Lower SWR
- Phase and amplitude matching

Cost Advantages — Integrated filter assemblies provide up to 30% cost savings

- Significant labor savings in system engineering, quality control, and assembly time
- Eliminates up to four connectors when integrated in a conventional semi-rigid cable assembly
- Compatible with standard semi-rigid connectors

APPLICATIONS

Suppression of undesired signals inherent in active transmitting sources such as:

- Transistor oscillators
- Gunn oscillators
- Impatt oscillators
- Traveling-wave tubes (TWT)
- Backward-wave oscillators (BWO)
- Klystrons
- Varactor multiplier chains
- YIG-tuned oscillators
- Solid-state amplifiers

Suppression of undesirable frequency bands in receiving systems such as:

- Radar warning receivers
- ECM receivers
- Rejection of sidebands
- Direction finding receivers

Suppression of undesirable signals in custom applications.

GENERAL TECHNICAL DATA

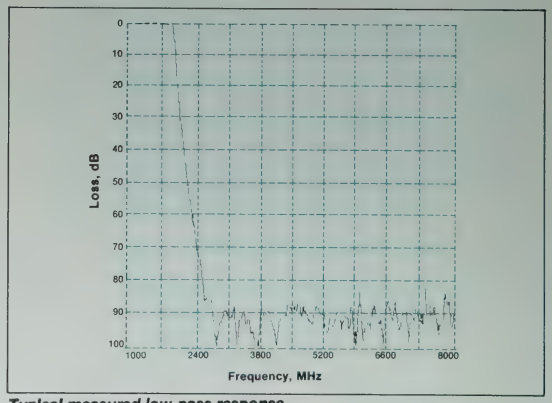
Micro-Coax Low-Pass Filters are available in cutoff frequencies ranging from 200 MHz to 22 GHz in standard 0.0865" (2.20mm); 0.141" (3.58mm); and 0.250" (6.35mm) tin-plated semi-rigid coaxial cable diameters.

Micro-Coax Bandpass Filters are available in bandwidths from 5% to 20% over 1 GHz to 18 GHz frequency range in standard 0.141" (3.58mm) tin-plated semi-rigid coaxial cable diameter.

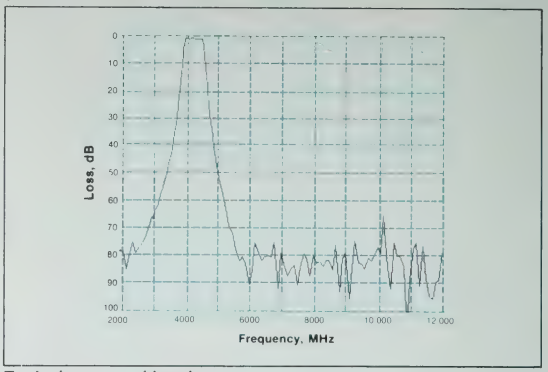
Micro-Coax High-Pass Filters are available in cutoff frequencies from 1 GHz to 4 GHz in standard 0.141" (3.58mm) tin-plated semi-rigid coaxial cable diameter.

Distributed and lumped element configurations, derived from Chebyshev designs, are incorporated within the cable. Design and performance specifications determine the number of sections. A typical measured response for a 17-element low-pass design is shown at right. Note the steep slope in the reject band typical of low-pass filters in this series. Typical measured responses are also shown for a 5-section bandpass filter and a 5-section high-pass filter.

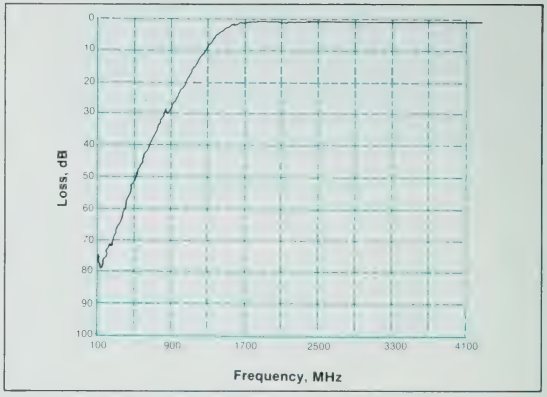
*Patent numbers 4,161,704, 4,266,207, and 4,329,667. Others pending.



Typical measured low-pass response (UT†† LC-141A-1800-17).



Typical measured bandpass response (UT BP-141A-4100/4500-5).



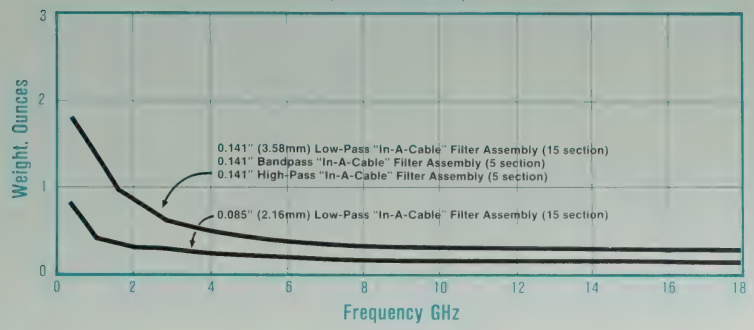
Typical measured high-pass response (UT-HP-141A-1850-5).

Weight.

The graph shows a weight/frequency comparison. Note that 0.141" Micro-Coax Low-Pass, Bandpass, and High-Pass "In-A-Cable" Filter Assemblies weigh less than an ounce at 2 GHz. Micro-Coax Low-Pass Filters within 0.085" cable weigh less than one-half an ounce at the same frequency.

WEIGHT GRAPH

(with 7mm Connectors)



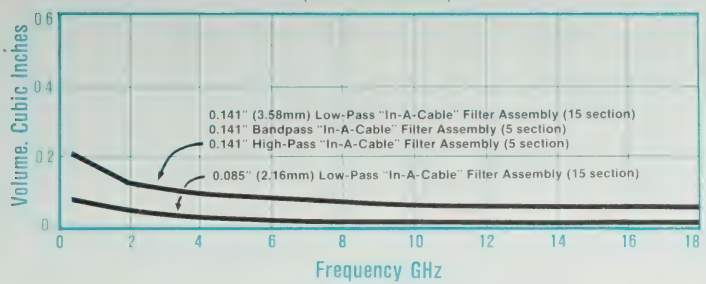
Weight versus Frequency

Space Requirements

The physical space required by Micro-Coax "In-A-Cable" Filter Assemblies is indicated in this graph. Notice that 0.141" Low-Pass, Bandpass, and High-Pass Filters use less than 0.15 cubic inch at 2 GHz. The smaller 0.085" Low-Pass Filter needs less than 0.1 cubic inch at the same frequency.

VOLUME GRAPH

(with 7mm Connectors)



Volume versus Frequency

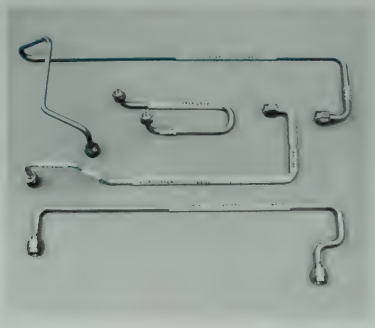
ENVIRONMENTAL CONDITIONS

Micro-Coax Bandpass, Low-Pass and High-Pass "In-A-Cable" Filters have been designed to withstand the following military-type environmental conditions:

- **Temperature Range:** From –55°C to +125°C
- **Shock:** MIL-STD-202F, Method 213B, Test Condition J — 30 gs with an 11 millisecond shock pulse in any three orthogonal planes.
  MIL-STD 816, Method 516, Procedure I, half sine pulse— 27 gs with an 11 millisecond shock pulse in any three orthogonal planes.
- **Temperature-Altitute:** MIL-STD-810B, Method 504, Procedure I, for Class 2 and Class 6 Equipment — 70,000 feet.
  MIL-STD-810B, Method 500, Procedure II — Sea level to 40,000 feet @ 0.5 inch mercury per second.
- **Vibration:** MIL-STD-202F, Method 240D, Test Condition C, Part 1, using (10g peak) a frequency range of 5 Hz to 2000 Hz.
- **Humidity:** MIL-STD-202F, Method 103B, Test Condition B — 90% to 95% x 96 hours.

Several Bandpass, Low-Pass and High-Pass Filters were temperature tested by Micro-Coax Components in the developmental phase to verify the above range. Shock, temperature-altitude, vibration and humidity testing was performed at an independent testing laboratory on five units of a representative Micro-Coax Low-Pass Filter (UT 141A-14,000-9). The testing yielded satisfactory results with the units mounted on a test fixture by their mating connectors to simulate a realistic sytem installation.

MICRO-COAX LOW-PASS "IN-A-CABLE" FILTERS



Typical Micro-Coax Low-Pass Filter "In-A-Cable" Assemblies in various configurations with from 7 sections to 21 sections.

LOW-PASS FILTER TECHNICAL DATA

Tables 15, 16, and 17 on pages 43 to 45 provide technical information on the passband and rejection band electrical characteristics, and physical data on 0.0865" (2.20mm), 0.141" (3.58mm), and 0.250" (6.35mm) diameter Low-Pass "In-A-Cable" Filters. The insertion loss is normally lower in the larger diameter cables for a given passband, however the 0.250" diameter cable is recommended for passbands up to 8000 MHz. All three diameter cables are available in the following configurations:

- Within a formed cable assembly.
- Minimum straight length as in Tables 15, 16, and 17
- With or without connectors. See Connector Option Guide on page 53.
- Straight lengths longer than the minimums on Tables 15, 16, and 17 — up to two additional feet (0.6096m) on each side of the filter.

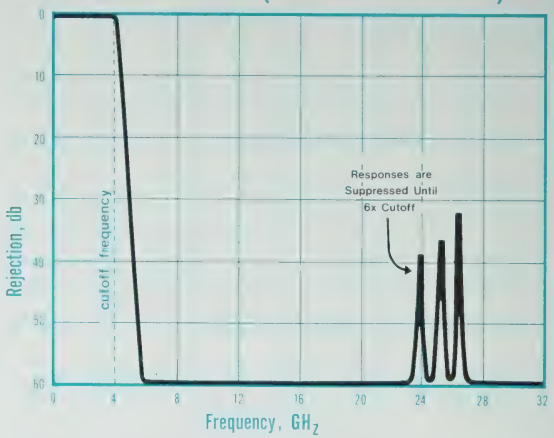
The Connector Option Guide on page 53 indicates the weight, recommended frequency range, and additional length which must be added to the minimum straight length to obtain the overall filter assembly length. For example, if a UT-LI-141A-12, 400-15 is selected from Table 15, it has a minimum straight length of 2.0" (50.80mm). If male and female SMA connectors are to be added, the total filter assembly length (with the connectors) changes:

2.0" + 0.445" + 0.500" = 2.945"

Similarly, the weight is estimated by combining the minimum straight length 0.2 ounces (5.67gr) from Table 15 with the weight of the two connectors chosen from the Connector Option Guide on page 53:

0.2 oz. + 0.07 oz. + 0.09 oz. = 0.36 oz.

Typical Spurious Response of Micro-Coax Low-Pass Filter (UT LI-141A-4000-15)



Suppression of Undesirable Signals.

Suppression of Undesirable Signals. As with filters of any type, the rejection or suppression of unwanted signals is important. The superior spurious response of 0.141" Micro-Coax Low-Pass Filters "In-A-Cable" are indicated in the graph above. Responses are suppressed until six times the cutoff frequency.

"IN-A-CABLE" LOW-PASS FILTER 0.01 RIPPLE DESIGN
MINIMUM REJECT BAND INSERTION LOSS
versus MULTIPLE OF CUTOFF FREQUENCY (f_o)

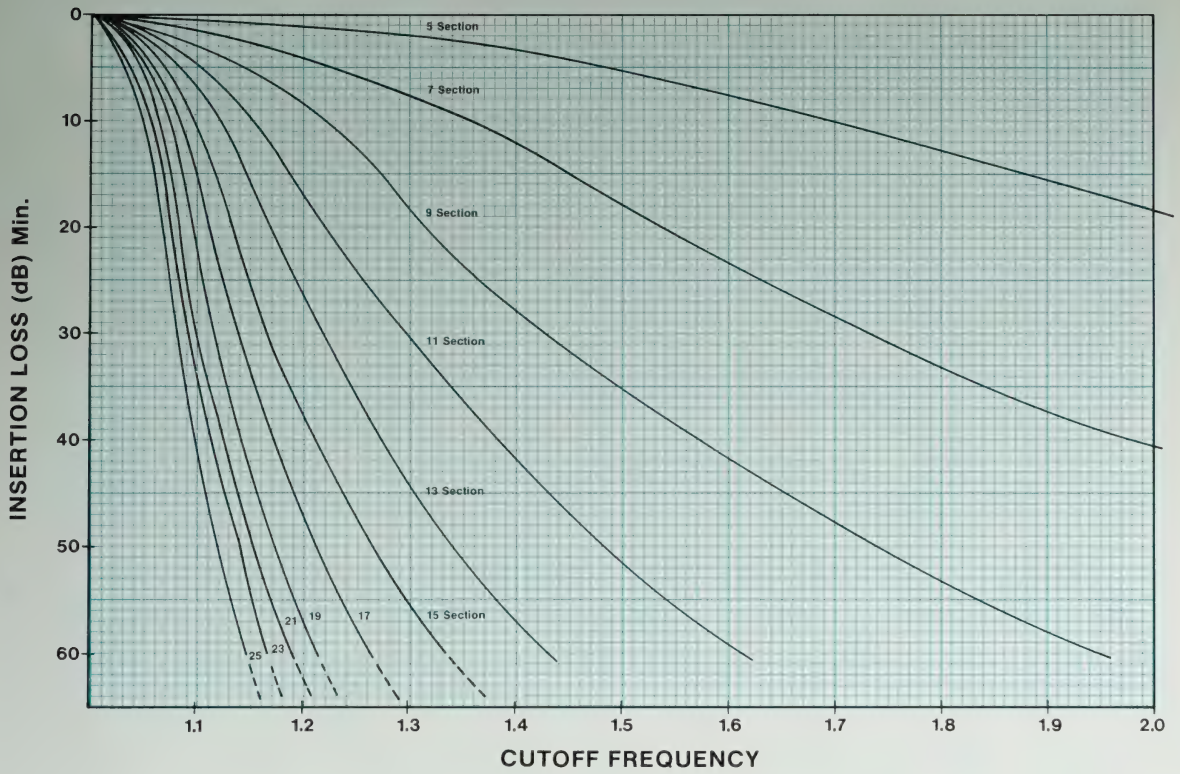


TABLE 15 — Micro-Coax Low-Pass "In-A-Cable" Filters, Standard Designs, 0.141" (3.58mm) Diameters

Micro-Coax Low-Pass "In-A-Cable" Filter Number	Passband (MHz)	Rejection Band Characteristics				Passband Characteristics		Minimum Straight Length without Connectors (inches/mm)	Nominal Weight without Connectors (oz/gr)
		3 dB Typical (MHz)	10 dB Typical (MHz)	30 dB Typical (MHz)	60 dB Minimum Stopband (MHz)	Insertion Loss (dB) (1)	Maximum SWR (1)		
UT LH-141A-250-7	D C -250	290	320	435	—	1.25	1.5:1	5.3/134.6	0.3/8.51
UT LH-141A-250-11	D C -250	270	280	310	420-18,000	2.0	1.5:1	8.4/213.4	0.5/14.2
UT LH-141A-400-7	D C -400	470	520	700	—	1.0	1.5:1	3.6/91.44	0.3/8.51
UT LH-141A-500-11	D C -500	540	560	625	820-18,000	1.4	1.5:1	4.7/119.4	0.3/8.51
UT LH-141A-750-11	D.C.-750	810	840	940	1,230-18,000	1.3	1.55:1	3.6/91.44	0.3/8.51
UT LH-141A-970-15	D.C.-970	1,020	1,040	1,110	1,340-5,800	0.95	1.6:1	6.0/152.4	0.4/11.3
UT LH-141A-1,220-11	D.C.-1,220	1,320	1,370	1,520	1,990-8,800	0.90	1.6:1	3.8/96.52	0.3/8.51
UT LC-141A-720-9	D.C.-720	800	840	980	1,500-3,500	0.60	1.35:1	8.4/213.4	0.5/14.2
UT LC-141A-920-9	D.C.-920	1,020	1,075	1,255	1,820-4,600	0.55	1.35:1	6.75/171.5	0.4/11.3
UT LC-141A-1,000-11	D.C.-1,000	1,060	1,110	1,220	1,600-5,600	0.70	1.35:1	8.1/205.7	0.5/14.2
UT LC-141A-1,000-15	D.C.-1,000	1,050	1,075	1,140	1,360-5,600	0.85	1.35:1	10.6/269.2	0.6/17.0
UT LC-141A-1,200-9	D.C.-1,200	1,330	1,400	1,640	2,360-6,000	0.55	1.35:1	5.4/137.2	0.3/8.51
UT LC-141A-1,215-9□	D.C.-1,215	1,350	1,430	1,680	2,500-6,400	0.60	1.35:1	5.3/134.6	0.3/8.51
UT LC-141A-1,280-13	D.C.-1,280	1,360	1,395	1,515	1,860-7,000	0.70	1.35:1	7.7/195.6	0.5/14.2
UT LC-141A-1,300-9	D.C.-1,300	1,410	1,480	1,720	2,450-6,500	0.55	1.35:1	5.2/132.1	0.3/8.51
UT LC-141A-1,300-11	D.C.-1,300	1,400	1,460	1,620	2,120-7,200	0.60	1.35:1	6.3/160.0	0.4/11.3
UT LC-141A-1,400-9	D C -1,400	1,520	1,590	1,850	2,630-7,000	0.55	1.35:1	4.9/124.5	0.3/8.51
UT LC-141A-1,400-15	D C -1,400	1,470	1,500	1,600	1,900-7,400	0.80	1.35:1	8.2/208.3	0.5/14.2
UT LC-141A-1,500-7	D C -1,500	1,750	1,930	2,600	—	0.40	1.35:1	3.4/86.36	0.2/5.67
UT LC-141A-1,500-15	D C -1,500	1,575	1,610	1,710	2,025-7,800	0.75	1.35:1	7.7/195.6	0.4/11.3
UT LC-141A-1,800-17	D C -1,800	1,870	1,900	1,990	2,300-10,200	0.90	1.45:1	7.3/185.4	0.4/11.3
UT LC-141A-2,000-15□	D C -2,000	2,100	2,150	2,280	2,700-11,000	0.70	1.35:1	5.8/147.3	0.3/8.51
UT LC-141A-2,050-21	D C -2,050	2,115	2,130	2,200	2,440-11,500	0.95	1.45:1	8.0/203.2	0.4/11.3
UT LI-141A-2,200-15□	D C -2,200	2,310	2,380	2,530	2,990-7,000	0.60	1.35:1	7.2/182.9	0.4/11.3
UT LI-141A-2,500-17	D C -2500	2,610	2,655	2,800	3,250-7,300	0.65	1.35:1	7.4/188.0	0.4/11.3
UT LI-141A-2,800-5	D C -2,800	3,690	4,290	8,200	—	0.30	1.35:1	1.8/45.72	0.1/2.84
UT LC-141A-2,920-11	D C -2,920	3,150	3,270	3,640	4,740-16,800	0.55	1.35:1	3.2/81.28	0.2/5.67
UT LI-141A-3,000-15	D C -3,000	3,150	3,220	3,420	4,070-15,400	0.60	1.35:1	4.2/106.7	0.2/5.67
UT LC-141A-3,020-17	D C -3,020	3,150	3,210	3,380	3,900-16,700	0.70	1.35:1	4.6/116.8	0.2/5.67
UT LI-141A-3,400-9	D C -3,400	3,775	3,970	4,630	6,650-8,250	0.45	1.35:1	3.2/81.28	0.2/5.67
UT LI-141A-3,600-9	D C -3,600	3,400	4,200	4,910	7,040-12,800	0.45	1.35:1	3.0/76.20	0.2/5.67
UT LC-141A-3,800-7	D C -3,800	4,440	4,880	6,590	—	0.40	1.35:1	2.2/55.88	0.1/2.84
UT LI-141A-3,800-11□	D C -3,800	4,110	4,290	4,780	6,260-19,900	0.60	1.35:1	2.8/71.12	0.2/5.67
UT LI-141A-4,000-15	D C -4,000	4,200	4,295	4,560	5,360-12,000	0.50	1.35:1	4.5/114.3	0.2/5.67
UT LI-141A-4,180-15	D C -4,180	4,390	4,490	4,770	5,610-21,000	0.55	1.35:1	3.4/86.36	0.2/5.67
UT LC-141A-4,200-7	D C -4,200	4,950	5,440	7,220	—	0.35	1.50:1	3.2/81.28	0.2/5.67
UT LI-141A-4,200-11□	D C -4,200	4,540	4,740	5,280	6,920-21,000	0.45	1.35:1	2.6/66.04	0.2/5.67
UT LI-141A-4,200-17	D C -4,200	4,360	4,420	4,630	5,260-12,600	0.55	1.35:1	4.8/121.9	0.2/5.67
UT LC-141A-4,700-17	D C -4,700	4,880	4,950	5,180	5,880-26,500	0.75	1.45:1	3.3/83.82	0.2/5.67
UT LC-141A-4,800-15□	D C -4,800	5,090	5,200	5,520	7,000-26,500	0.75	1.45:1	2.9/73.66	0.2/5.67
UT LI-141A-5,000-7	D C -5,000	5,840	6,430	8,670	—	0.35	1.45:1	1.8/45.72	0.1/2.84
UT LC-141A-5,000-15	D C -5,000	5,250	5,370	5,700	6,720-26,500	0.55	1.35:1	2.9/73.66	0.2/5.67
UT LI-141A-5,000-15	D C -5000	5,250	5,370	5,700	6,720-16,000	0.50	1.35:1	3.7/93.98	0.2/5.67
UT LI-141A-5,000-21	D C -5,000	5,190	5,240	5,450	6,050-15,000	0.70	1.35:1	5.0/127.0	0.2/5.67
UT LI-141A-5,800-21	D C -5,800	6,020	6,080	6,330	7,000-17,000	0.70	1.40:1	4.7/119.4	0.2/5.67
UT LI-141A-6,000-9	D C -6,000	6,660	7,010	8,180	11,730-18,000	0.45	1.35:1	2.2/55.88	0.1/2.84
UT LI-141A-6,000-15	D C -6,000	6,300	6,440	6,840	8,050-18,000	0.50	1.35:1	3.2/81.28	0.2/5.67
UT LI-141A-6,500-23	D C -6,500	6,710	6,770	7,000	7,600-26,500	0.80	1.40:1	3.4/86.36	0.2/5.67

TABLE 15 — Micro-Coax Low-Pass "In-A-Cable" Filters, Standard Designs, 0.141" (3.58mm) Diameters

Micro-Coax Low-Pass "In-A-Cable" Filter Number	Passband (MHz)	Rejection Band Characteristics				Passband Characteristics		Minimum Straight Length without Connectors [2] (inches/mm)	Nominal Weight without Connectors (oz/gr)
		3 dB Typical (MHz)	10 dB Typical (MHz)	30 dB Typical (MHz)	60 dB Minimum Stopband (MHz)	Insertion Loss (dB) [1]	Maximum SWR [1]		
UT LI-141A-6,600-13□	D.C.-6,600	7,010	7,200	7,800	9,500-26,500	0.60	1.40:1	2.2/55.88	0.1/2.84
UT LI-141A-7,000-7	D.C.-7,000	8,175	9,000	12,140	—	0.35	1.40:1	1.7/43.18	0.1/2.84
UT LI-141A-7,000-13	D.C.-7,000	7,430	7,640	8,270	10,070-26,500	0.60	1.40:1	2.2/55.88	0.1/2.84
UT LI-141A-7,200-15	D.C.-7,200	7,565	7,730	8,210	9,650-21,600	0.60	1.40:1	3.0/76.20	0.2/5.67
UT LI-141A-7,500-7	D.C.-7,500	8,760	9,640	13,000	—	0.45	1.40:1	1.7/43.18	0.1 2.84
UT LI-141A-7,500-9	D.C.-7,500	8,260	8,760	10,300	14,700-22,000	0.70	1.40:1	2.0/50.8	0.1 2.84
UT LI-141A-8,000-7	D.C.-8,000	9,380	10,360	13,360	—	0.35	1.35:1	1.6/40.64	0.1 2.84
UT LI-141A-8,000-9	D.C.-8,000	8,880	9,345	10,900	15,630-24,000	0.50	1.40:1	1.8 45.72	0.1 2.84
UT LI-141A-8,000-15□	D.C.-8,000	8,400	8,590	9,120	10,730-24,000	0.60	1.40:1	2.6/66.04	0.2/5.67
UT LI-141A-8,000-21	D.C.-8,000	8,300	8,380	8,710	9,620-24,000	0.70	1.45:1	3.4/86.36	0.2/5.67
UT LI-141A-8,100-11	D.C.-8,100	8,600	8,890	9,840	12,650-26,500	0.60	1.45:1	1.9/48.26	0.1/2.84
UT LI-141A-8,100-21	D.C.-8,100	8,355	8,430	8,700	9,480-26,500	0.80	1.55:1	2.8/71.12	0.2/5.67
UT LI-141A-8,250-19	D.C.-8,250	8,580	8,690	9,075	10,150-26,500	0.70	1.45:1	2.6/60.04	0.2/5.67
UT LI-141A-8,400-19	D.C.-8,400	8,740	8,930	9,280	10,380-26,500	0.60	1.45:1	3.0/76.20	0.2/5.67
UT LI-141A-8,400-23□	D.C.-8,400	8,660	8,720	8,970	9,700-25,200	0.80	1.55:1	3.6/91.44	0.2/5.67
UT LI-141A-8,400-25	D.C.-8,400	8,650	8,700	8,900	9,550-24,500	0.90	1.65:1	4.0/101.6	0.2/5.67
UT LI-141A-8,500-9	D.C.-8,500	9,430	9,930	11,580	16,600-25,500	0.50	1.40:1	1.8/45.72	0.1 2.84
UT LI-141A-8,550-25	D.C.-8,550	8,980	9,000	9,080	9,740-25,600	0.80	1.55:1	3.9/99.06	0.2 5.67
UT LI-141A-9,000-15	D.C.-9,000	9,460	9,660	10,260	12,050-26,500	0.55	1.45:1	2.5/63.50	0.2 5.67
UT LI-141A-9,800-7	D.C.-9,800	11,450	12,600	16,980	—	0.50	1.45:1	1.5/38.10	0.1 2.84
UT LI-141A-10,000-15□	D.C.-10,000	10,500	10,830	11,510	13,500-26,500	0.55	1.45:1	2.4/60.96	0.1 2.84
UT LI-141A-10,500-19	D.C.-10,500	11,100	11,200	11,600	13,400-26,500	0.65	1.50:1	2.6/66.04	0.2 5.67
UT LI-141A-11,000-9	D.C.-11,000	12,210	12,850	14,990	21,470-26,500	0.60	1.50:1	2.6/66.04	0.2 5.67
UT LI-141A-11,000-21	D.C.-11,000	11,410	11,520	11,970	13,200-26,500	0.70	1.50:1	2.7/68.58	0.2 5.67
UT LI-141A-12,500-7	D.C.-12,500	14,600	16,070	21,650	—	0.45	1.45:1	1.4 35.56	0.1 2.84
UT LI-141A-12,400-15□	D.C.-12,400	13,030	13,310	14,130	16,600-26,500	0.65	1.50:1	2.0 50.80	0.2 5.67
UT LI-141A-12,840-21	D.C.-12,840	13,310	13,570	14,020	15,470-26,500	0.65	1.60:1	2.5 63.50	0.1 2.84
UT LI-141A-13,000-7	D.C.-13,000	15,180	16,710	22,550	—	0.60	1.55:1	1.4 35.56	0.1 2.84
UT LI-141A-13,400-21	D.C.-13,400	13,830	13,950	14,380	15,650-26,500	0.80	1.65:1	2.6 66.04	0.2 5.67
UT LI-141A-14,000-9	D.C.-14,000	15,540	16,350	19,075	27,300	0.65	1.55:1	1.6 40.64	0.1 2.84
UT LI-141A-14,300-13	D.C.-14,300	15,185	15,610	16,900	20,530-26,500	0.65	1.55:1	1.8 45.72	0.1 2.84
UT LI-141A-15,000-15	D.C.-15,000	15,760	16,100	17,090	20,100-26,500	0.75	1.60:1	1.9 48.26	0.1 2.84
UT LI-141A-16,300-13	D.C.-16,300	17,310	17,790	19,260	23,390-26,500	0.70	1.60:1	1.7 43.18	0.1 2.84
UT LI-141A-17,000-23	D.C.-17,000	17,560	17,710	18,270	20,000-26,500	0.90	1.70:1	2.3 58.42	0.2 5.67
UT LI-141A-18,000-15□	D.C.-18,000	18,900	19,510	20,710	24,300-26,500	0.75	1.65:1	1.8 45.72	0.1 2.84
UT LI-141A-18,000-21	D.C.-18,000	18,670	18,850	19,550	21,550-26,500	0.90	1.75:1	2.1 53.34	0.2 5.67
UT LI-141A-18,300-21	D.C.-18,300	18,880	19,050	19,640	21,350-26,500	0.95	1.80:1	2.1 53.34	0.2 5.67
UT LI-141A-18,500-13	D.C.-18,500	19,650	20,190	21,860	26,540	0.80	1.70:1	1.6 40.64	0.1 2.84
UT LI-141A-18,500-17	D.C.-18,500	19,320	19,645	20,600	23,550-26,500	0.85	1.70:1	1.8 45.72	0.1 2.84

Power Rating - 100 watts at 10 GHz unless further limited by connector chosen. **Impedance:** 50 ohms Patent Number 4,161,704

For other current designs, consult Micro-Coax Components, Inc.

NOTES

1. A slight variation in these values is possible depending on the type of connector selected from Connector Option Guide, page 54.
2. Additional length can be specified to make a filter/cable assembly with a preformed shape using a minimum inside bend radius of 0.250 inch.

□ Filter Train. Normally, 3-week delivery.

TABLE 16 — Micro-Coax Low-Pass "In-A-Cable" Filters, Standard Designs, 0.085" (2.159mm) Diameters

Micro-Coax Low-Pass "In-A-Cable" Filter Number	Passband (MHz)	Rejection Band Characteristics				Passband Characteristics		Minimum Straight Length without Connectors [2] (inches/mm)	Nominal Weight without Connectors (oz/gr)
		3 dB Typical (MHz)	10 dB Typical (MHz)	30 dB Typical (MHz)	60 dB Minimum Stopband (MHz)	Insertion Loss (dB) [1]	Maximum SWR [1]		
UT LC-85-2,000-15	D.C.-2,000	2,100	2,140	2,320	2,700-6,000	0.95	1.35:1	6.5/165.1	0.2/5.67
UT LI-85-3,000-15	D.C.-3,000	3,151	3,220	3,430	4,020-10,000	0.75	1.35:1	5.5/139.7	0.2/5.67
UT LC-85-3,450-11	D.C.-3,450	3,730	3,860	4,300	5,600-14,000	0.70	1.35:1	3.3/83.82	≤0.1/2.84
UT LC-85-3,750-11	D.C.-3,750	4,050	4,200	4,680	6,090-16,000	0.70	1.35:1	3.1/78.74	≤0.1/2.84
UT LC-85-4,120-7	D.C.-4,120	4,810	5,300	7,150	—	0.55	1.40:1	2.0/50.80	≤0.1/2.84
UT LI-85-4,400-13/10,000-9□	D.C.-4,400	4,675	4,800	5,210	10,000-40,000	0.95	1.45:1	4.0/101.6	≤0.1/2.84
UT LI-85-4,400-15	D.C.4,400	4,620	4,725	5,020	5,890-17,000	0.85	1.45:1	3.7/93.98	≤0.1/2.84
UT LI-85-5,000-15	D.C.-5,000	5,250	5,370	5,710	6,690-18,000	0.85	1.40:1	3.5/88.90	≤0.1/2.84
UT LI-85-6,000-13□	D.C.-6,000	6,370	6,550	7,100	8,640-23,000	0.75	1.45:1	2.7/68.58	≤0.1/2.84
UT LI-85-6,200-13	D.C.-6,200	6,585	6,770	7,340	8,930-24,000	0.75	1.45:1	2.6/66.04	≤0.1/2.84
UT LI-85-6,500-9	D.C.-6,500	7,215	7,590	8,870	12,700-26,500	0.65	1.45:1	2.0/50.80	≤0.1/2.84
UT LI-85-7,400-19	D.C.-7,400	7,700	7,800	8,150	9,100-28,000	1.00	1.55:1	3.1/78.74	≤0.1/2.84
UT LI-85-10,000-15	D.C.-10,000	10,510	10,740	11,410	13,400-38,500	0.75	1.55:1	2.2/55.88	≤0.1/2.84
UT LI-85-10,100-9	D.C.-10,100	11,210	11,800	13,770	19,710-40,000	0.65	1.60:1	1.7/43.18	≤0.1/2.84
UT LI-85-10,500-7	D.C.-10,500	12,260	13,500	18,200	—	0.70	1.60:1	1.5/38.10	≤0.1/2.84
UT LI-85-10,800-19□	D.C.-10,800	11,175	11,300	11,700	13,100-39,000	1.10	1.75:1	2.5/63.50	≤0.1/2.84
UT LI-85-12,400-15	D.C.-12,400	13,030	13,310	14,140	16,600-37,000	0.90	1.65:1	2.2/55.88	≤0.1/2.84
UT LI-85-13,500-7	D.C.-13,500	15,770	17,350	23,400	19,380-40,000	0.80	1.70:1	1.4/35.56	≤0.1/2.84
UT LI-85-16,000-15□	D.C.-16,000	16,810	17,180	18,240	21,400-40,000	1.05	1.80:1	1.7/43.18	≤0.1/2.84
UT LI-85-18,000-15	D.C.-18,000	18,910	19,320	20,520	24,100-40,000	1.05	1.80:1	1.7/43.18	≤0.1/2.84
UT LI-85-18,400-19□	D.C.-18,400	19,040	19,260	19,980	22,200-40,000	1.30	1.8:1	1.9/48.26	≤0.1/2.84
UT LI-85-22,000-13□	D.C.-22,000	23,360	24,010	26,020	31,550-40,000	1.00	1.8:1	1.6/40.64	≤0.1/2.84
UT LI-85-26,500-15□	D.C.-26,500	27,840	28,450	30,210	35,450-40,000	1.05	1.80:1	1.6/40.64	≤0.1/2.84

Power Rating - 35 watts at 10 GHz unless further limited by connector chosen. **Impedance:** 50 ohms Patent Number 4,161,704

For other current designs, consult Micro-Coax Components, Inc.

NOTES

1. A slight variation in these values is possible depending on the type of connector selected from Connector Option Guide, page 54.
2. Additional length can be specified to make a filter/cable assembly with a preformed shape using a minimum inside bend radius of 0.125 inch.

□ Filter Train. Normally, 3-week delivery.

TABLE 17 — Micro-Coax Low-Pass "In-A-Cable" Filters, Standard Designs, 0.250" (6.35mm) Diameters

Micro-Coax Low-Pass "In-A-Cable" Filter Number	Passband (MHz)	Rejection Band Characteristics				Passband Characteristics		Minimum Straight Length without Connectors [2] (inches/mm)	Nominal Weight without Connectors (oz/gr)
		3 dB Typical (MHz)	10 dB Typical (MHz)	30 dB Typical (MHz)	60 dB Minimum Stop Band (MHz)	Insertion Loss (dB) [1]	Maximum VSWR [1]		
UT LC-250A-1,220-13/2,500-5	D.C.-1,220	1,295	1,330	1,440	1,800-12,000	0.50	1.35:1	8.5/190.5	1.1/31.2
UT LI-250A-5,000-9	D.C.-5,000	5,550	5,840	6,820	9,790-13,500	0.45	1.45:1	2.4/60.96	0.4/11.3
UT LI-250A-6,400-7	D.C.-6,400	7,480	8,230	11,100	—	0.45	1.50:1	1.8/45.72	0.4/11.3
UT LI-250A-7,000-15	D.C.-7,000	7,355	7,515	7,980	9,350-13,500	0.55	1.55:1	2.8/71.12	0.4/11.3
UT LI-250A-7,200-9	D.C.-7,200	7,990	8,410	8,920	14,070-13,500	0.55	1.45:1	1.9/48.26	0.4/11.3

Power Rating - 250 watts at 8 GHz unless further limited by connector chosen. **Impedance:** 50 ohms Patent Number 4,161,704

For other current designs, consult Micro-Coax Components, Inc.

NOTES

1. A slight variation in these values is possible depending on the type of connector selected from Connector Option Guide, page 54.
2. Additional length can be specified to make a filter/cable assembly with a preformed shape using a minimum inside bend radius of 0.375 inch.

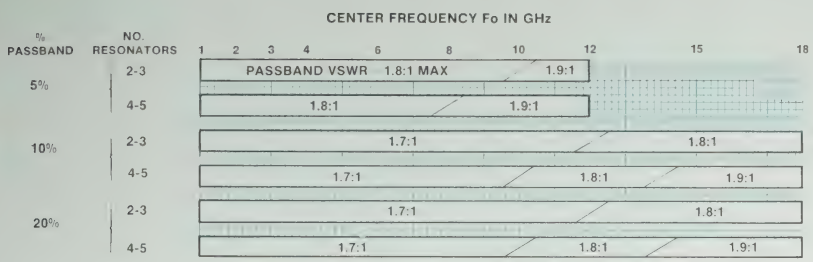
MICRO-COAX BANDPASS "IN-A-CABLE" FILTERS

BANDPASS FILTER TECHNICAL DATA

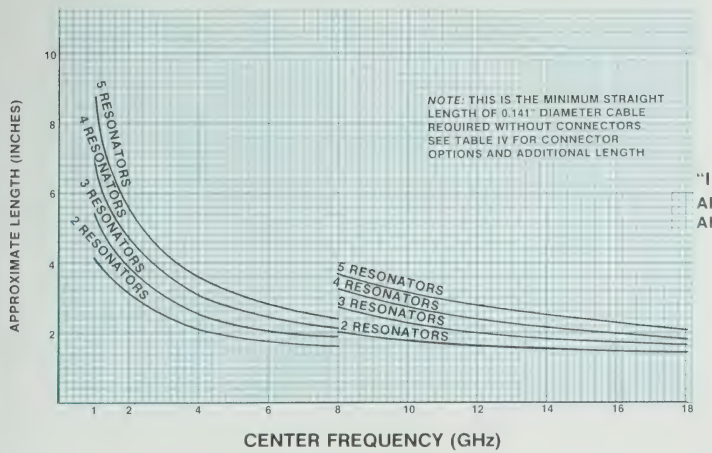
Bandpass "In-A-Cable" Filters are available in 0.141" (3.58mm) semi-rigid coaxial cable diameters in the following configurations:

- Within a formed cable assembly.
- Minimum straight length as indicated below.
- With or without connectors. See Connector Options Guide on page 53.
- Straight lengths longer than those indicated below — up to two additional feet (0.6096m) on each side of the filter.

The graphs on pages 47 to 49 indicate maximum insertion loss for various bandwidths and minimum rejection above and below the 8 GHz range for various bandwidths. Table 18 on page 50 provides passband and rejection band electrical characteristics, and physical data on Bandpass "In-A-Cable" Filters.

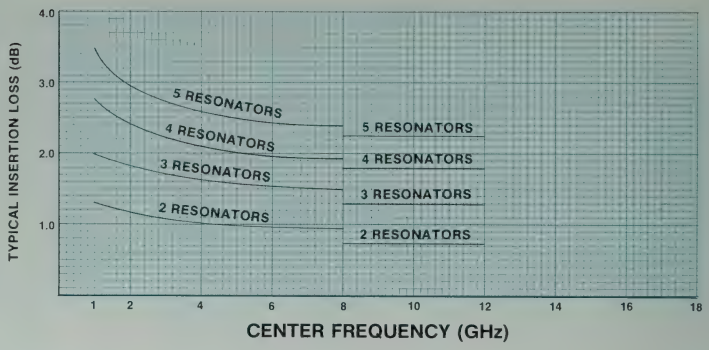


"IN-A-CABLE" BANDPASS FILTER
MAXIMUM PASSBAND SWR VS. Fo AND NUMBER OF RESONATORS

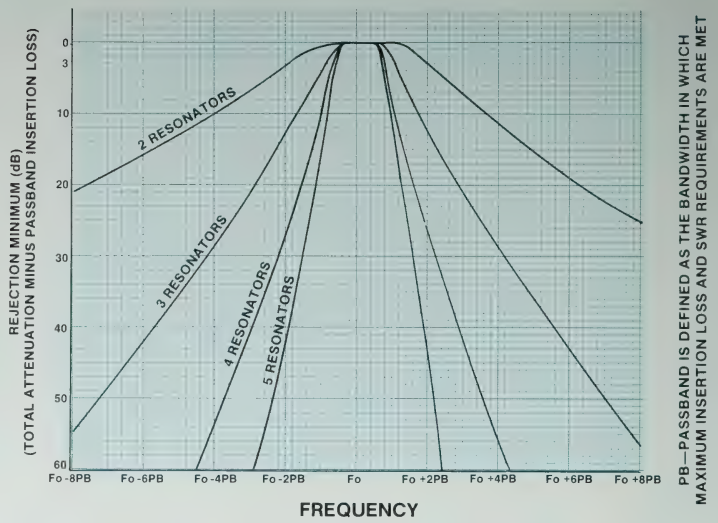


"IN-A-CABLE" BANDPASS FILTER
APPROXIMATE LENGTH VS. CENTER FREQUENCY AND NUMBER OF RESONATORS

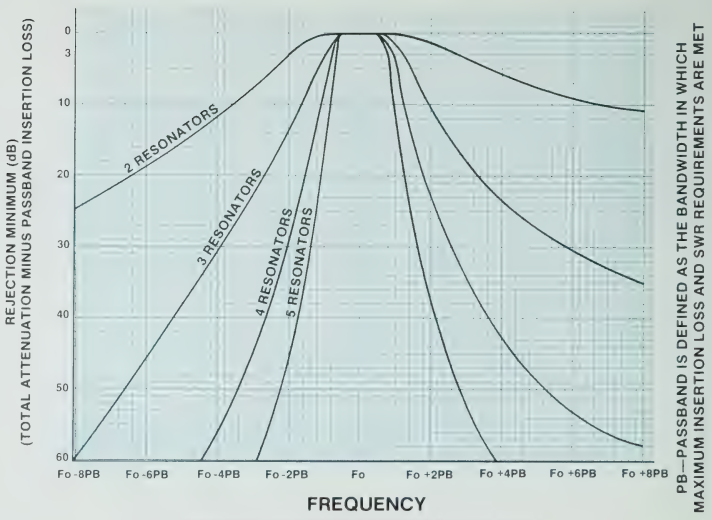
"IN-A-CABLE" BANDPASS FILTER
TYPICAL MAXIMUM PASSBAND INSERTION LOSS VS. CENTER FREQUENCY AND NUMBER OF RESONATORS FOR 5% BANDWIDTH



"IN-A-CABLE" BANDPASS FILTER
MINIMUM REJECTION VS. CENTER FREQUENCY 5% BANDWIDTH OVER THE 1-8 GHz RANGE

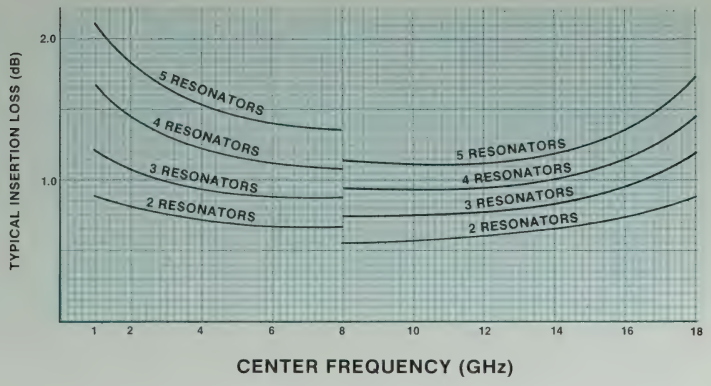


"IN-A-CABLE" BANDPASS FILTER
MINIMUM REJECTION VS. CENTER FREQUENCY FOR 5% BANDWIDTH OVER THE 8-12 GHz RANGE

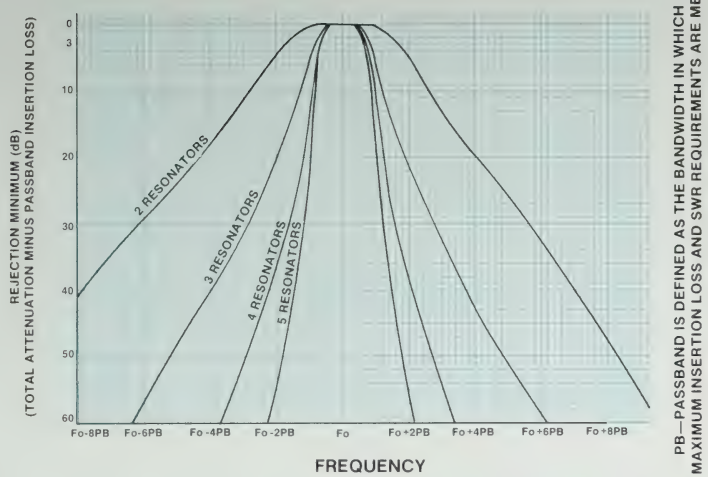


SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

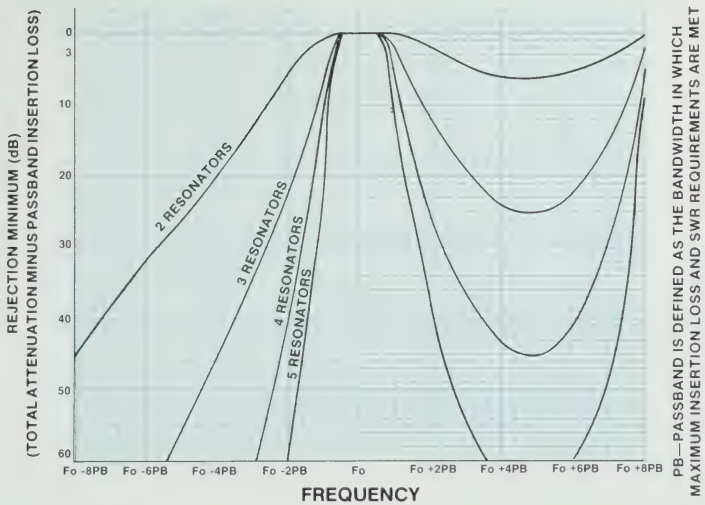
"IN-A-CABLE" BANDPASS FILTER
TYPICAL MAXIMUM PASSBAND INSERTION LOSS VS. CENTER FREQUENCY AND NUMBER OF RESONATORS FOR 10% BANDWIDTH

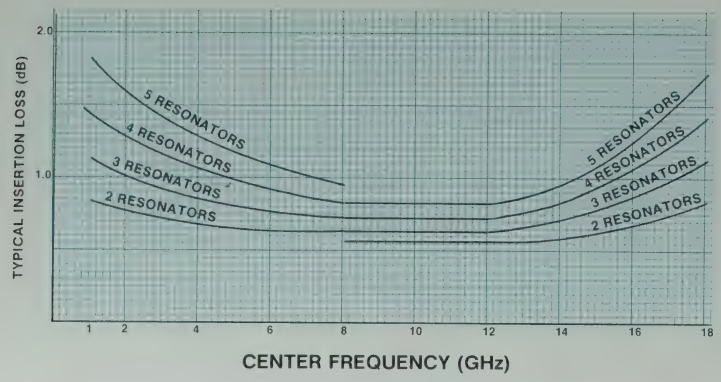


"IN-A-CABLE" BANDPASS FILTER
MINIMUM REJECTION VS. CENTER FREQUENCY FOR 10% BANDWIDTH OVER THE 1-8 GHz RANGE

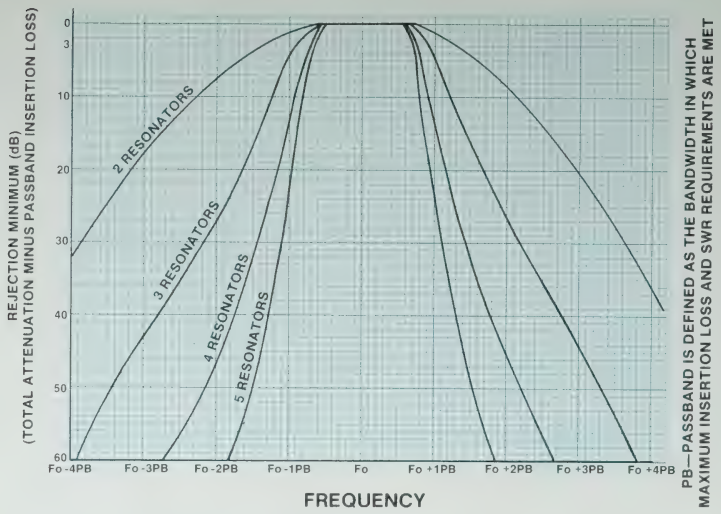


"IN-A-CABLE" BANDPASS FILTER
MINIMUM REJECTION VS. CENTER FREQUENCY FOR 10% BANDWIDTH OVER THE 8-18 GHz RANGE

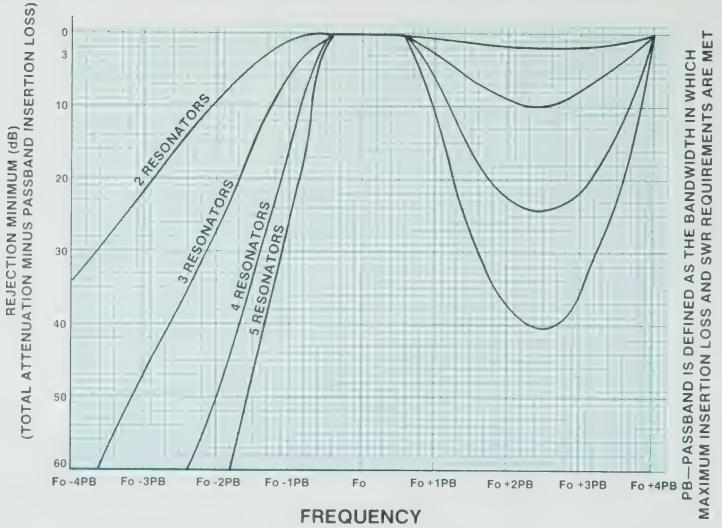




"IN-A-CABLE" BANDPASS FILTER
TYPICAL MAXIMUM PASSBAND INSERTION LOSS VS. CENTER FREQUENCY AND NUMBER OF RESONATORS FOR 20% BANDWIDTH



"IN-A-CABLE" BANDPASS FILTER
MINIMUM REJECTION VS. CENTER FREQUENCY FOR 20% BANDWIDTH OVER THE 1-8 GHz RANGE



"IN-A-CABLE" BANDPASS FILTER
MINIMUM REJECTION VS. CENTER FREQUENCY FOR 20% BANDWIDTH OVER THE 8-18 GHz RANGE

TABLE 18 — Micro-Coax Bandpass "In-A-Cable" Filters, Typical Custom Designs 0.141" (3.58mm) Diameters

Micro-Coax Bandpass "In-A-Cable" Filter Number	Passband (MHz)	Rejection Band					Passband Characteristics		Minimum Straight Length without Connectors [2] (inches/mm)
		10 dB Typical (MHz)	20 dB Typical (MHz)	30 dB Typical (MHz)	40 dB Typical (MHz)	50 dB Typical (MHz)	Maximum Insertion Loss (dB) [1]	Maximum SWR [1]	
UT BP-141A-1,800/1,900-3	1,800-1,900	1,325/ —	1,074/ —	825/ —	480/ —	190/ —	0.50	1.40:1	6.0/152.4
UT BP-141A-2,375/2,625-5	2,375-2,625	2,250/2,700	2,200/2,750	2,125/2,800	2,050/2,850	1,800/3,000	1.50	1.80:1	4.8/121.9
UT BP-141A-2,400/3,500-5	2,400-3,500	1,900/3,800	1,750/4,000	1,300/4,200	800/4,500	250/5,150	0.75	1.65:1	4.4/111.8
UT BP-141A-2,700/3,100-5	2,700-3,100	2,475/3,300	2,400/3,375	2,275/3,450	2,100/3,575	1,800/3,700	1.50	1.65:1	4.0/101.6
UT BP-141A-2,900/4,100-6	2,900-4,100	2,375/4,325	2,150/4,450	1,700/4,600	1,175/4,800	500/5,000	0.80	1.60:1	3.6/91.44
UT BP-141A-2,970/3,630-5	2,970-3,630	2,750/3,825	2,640/3,925	2,450/4,050	2,200/4,180	2,000/4,500	1.00	1.65:1	3.5/88.9
UT BP-141A-3,700/4,200-5	3,700-4,200	3,425/4,350	3,300/4,450	3,150/4,600	2,900/4,825	2,600/4,950	1.40	1.70:1	3.3/83.82
UT BP-141A-3,750/4,250-4	3,750-4,250	3,450/4,425	3,250/4,550	3,025/4,750	2,650/4,875	2,250/5,250	1.40	1.70:1	2.7/68.58
UT BP-141A-3,900/4,700-5	3,900-4,700	3,550/5,150	3,325/5,300	3,100/5,550	2,800/5,700	2,400/5,900	1.40	1.70:1	3.0/76.2
UT BP-141A-4,100/4,500-5	4,100-4,500	3,900/4,675	3,825/4,750	3,750/4,850	3,500/5,000	3,200/5,200	1.60	1.70:1	3.0/76.2
UT BP-141A-5,800/6,400-4	5,800-6,400	5,300/6,800	4,850/7,100	4,500/7,500	4,300/7,850	4,100/8,000	1.20	1.70:1	2.5/63.5
UT BP-141A-7,600/8,200-3	7,600-8,200	7,000/9,000	6,600/10,000	6,250/11,500	5,750/ —	4,900/ —	1.20	1.70:1	2.5/63.5
UT BP-141A-8,200/9,000-4	8,200-9,000	7,800/9,500	7,600/10,000	7,350/10,600	7,050/ —	6,650/ —	1.10	1.70:1	3.0/76.2
UT BP-141A-8,200/9,000-5	8,200-9,000	7,950/9,350	7,850/9,500	7,700/10,000	7,450/11,000	7,200/12,000	1.30	1.70:1	3.5/88.9
UT BP-141A-8,400/9,100-5	8,400-9,100	8,300/9,300	8,200/9,450	8,050/9,650	7,850/9,900	7,675/10,275	1.50	1.80:1	3.5/88.9
UT BP-141A-8,640/9,360-5	8,640-9,360	8,400/9,575	8,200/9,450	8,000/9,625	7,800/10,250	7,500/10,700	1.25	1.65:1	3.0/76.2
UT BP-141A-8,900/9,400-5	8,900-9,400	8,675/9,525	8,550/9,650	8,425/9,800	8,300/10,000	8,000/10,300	2.00	1.80:1	3.4/86.36
UT BP-141A-12,200/12,700-3	12,200-12,700	11,700/13,250	11,500/13,900	11,000/14,900	10,400 —	9,600/ —	1.40	1.70:1	2.0/50.8
UT BP-141A-14,250/15,250-6	14,250-15,250	14,000/15,500	13,900/15,750	13,700/16,000	13,500/16,250	13,200/16,700	2.10	1.70:1	2.4/60.96
UT BP-141A-14,400/17,600-5	14,400-17,600	13,500/19,500	12,800/21,150	12,175/ —	11,250/ —	11,000/ —	1.00	1.80:1	2.2/55.88
UT BP-141A-15,520/16,480-4	15,520-16,480	15,000/17,100	14,750/17,500	14,350/18,250	14,000/19,500	13,400/ —	1.00	1.70:1	2.0/50.8
UT BP-141A-16,000/18,000-3	16,000-18,000	14,250/22,000	12,750/ —	11,250/ —	10,000/ —	8,000/ —	1.10	1.80:1	1.6/40.64
UT BP-141A-20,500/22,200-3	20,500-22,200	18,000/24,500	16,500/ —	15,000/ —	13,000/ —	11,000/ —	1.50	1.80:1	1.6/40.64

Patent Numbers 4,266,207 4,329,667

Impedance: 50 ohm

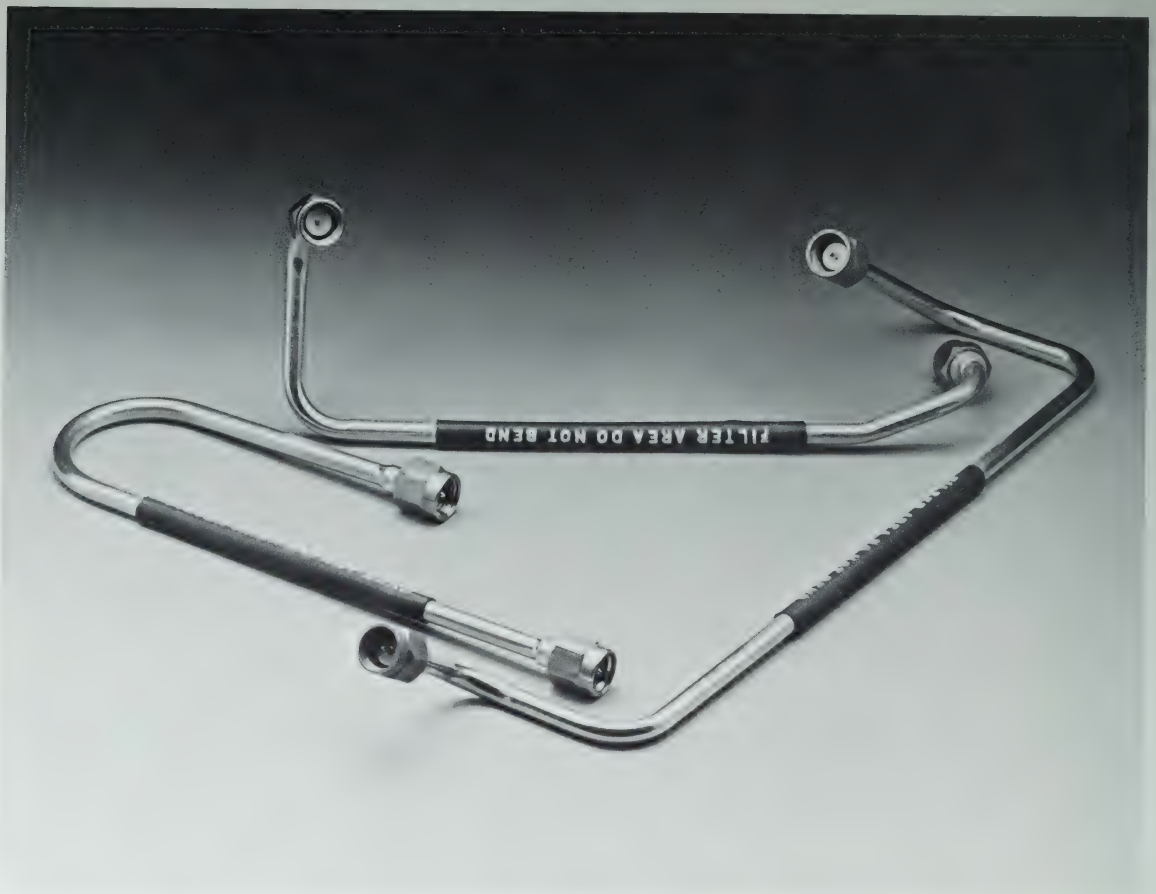
NOTES

1. A slight variation in these values is possible depending on the type of connector selected from Connector Option Guide, page 54.
2. Additional length can be specified to make a filter/cable assembly with a preformed shape using a minimum inside bend radius of 0.250 inch.

MICRO-COAX HIGH-PASS "IN-A-CABLE" FILTERS

In addition to Low-Pass and Bandpass "In-A-Cable" Filters, Micro-Coax Components produces High-Pass "In-A-Cable" Filters which transmit all frequencies above a given cutoff frequency while substantially attenuating all other frequencies. High-Pass Filters provide a DC block on the center conductor. They eliminate switching noise from solid state switches operating in the 500 MHz to 1 GHz range. They are currently available in 0.141" (6.35mm) diameter coaxial cables and can be designed to meet your specific requirements.

The insertion loss chart and Table 19 on the next page provide detailed technical information on Micro-Coax High-Pass "In-A-Cable" Filters.



"IN-A-CABLE" HIGH-PASS FILTER MINIMUM REJECT BAND INSERTION LOSS versus CUTOFF FREQUENCY (f_o)

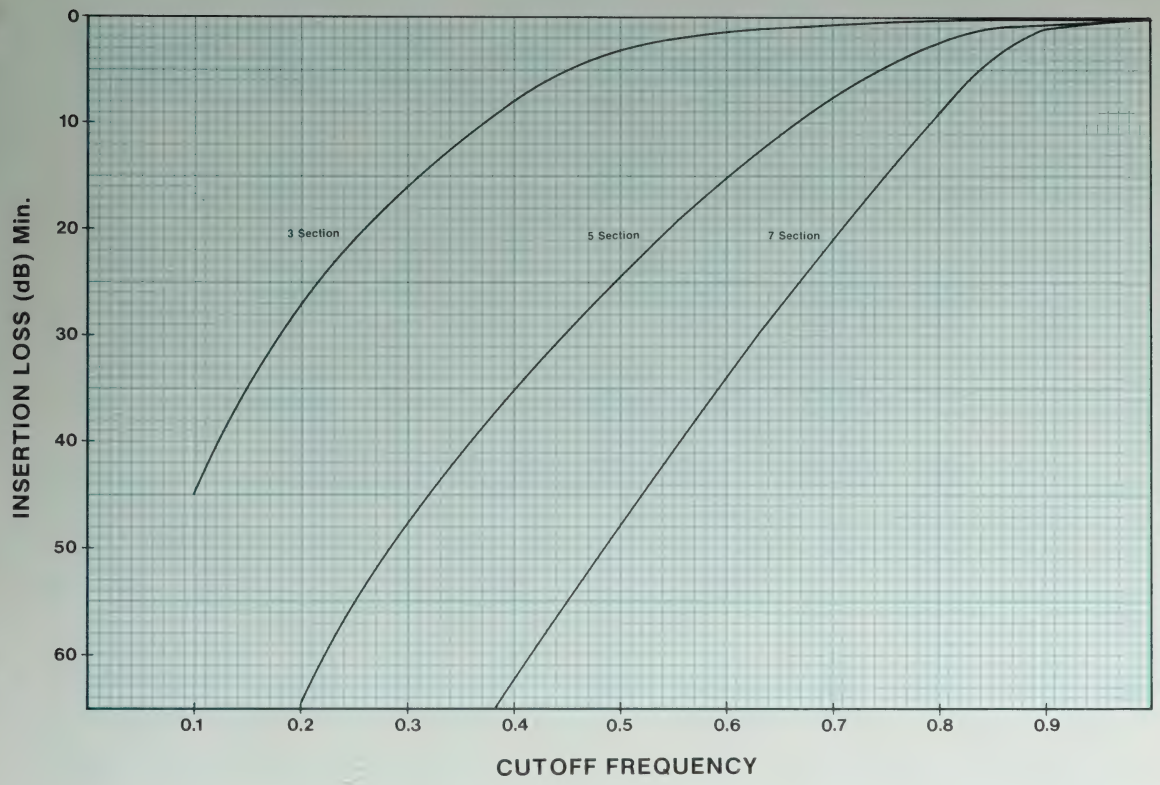


TABLE 19 — Micro-Coax High-Pass "In-A-Cable" Filters. Typical Designs, 0.141" (3.58mm) Diameters

Micro-Coax High-Pass "In-A-Cable" Filter Number	Typical Passband (MHz)	Rejection Band Characteristics				Passband Characteristics		Minimum Straight Length Without Connectors (inches mm)
		3 dB Typical (MHz)	10 dB Typical (MHz)	30 dB Typical (MHz)	60 dB Minimum Stopband (MHz)	Insertion Loss (dB)	Maximum SWR	
UT†† HP-141A-1000-5	1000-5000	750	650	450	D.C.-200	1.5	1.8:1	1.375
UT HP-141A-1650-5	1650-8250	1300	1100	750	D.C.-350	1.5	1.8:1	1.375
UT HP-141A-2500-5	2500-11500	2000	1650	1125	D.C.-550	1.0	1.8:1	1.375
UT HP-141A-4000-5	4000-18000	3100	2650	1800	D.C.-875	1.0	1.8:1	1.375

The values above are typical. Only specifications in response to Requests For Quotations are guaranteed.
For other current designs, consult Micro-Coax Components, Inc.

CONNECTOR OPTION GUIDE

Connector Type	Low-Pass Filters Only — 0.250" Diameter Cable Connectors		All "In-A-Cable" Filters — 0.141" Diameter Cable Connectors		Low-Pass Filters Only — 0.0865" Diameter Cable Connectors		Recommended Frequency Range (MHz)
	Nominal Additional Length Per End (inches/mm)	Nominal Additional Weight (ounces/gr)	Nominal Additional Length Per End (inches/mm)	Nominal Additional Weight (ounces/gr)	Nominal Additional Length Per End (inches/mm)	Nominal Additional Weight (ounces/gr)	
N Male	1.34/34.04	1.28/36.29	0.970/24.64	1.05/29.77	0.970/24.64	1.02/28.92	D.C.-12.400
N Female	1.12/28.45	0.86/24.38	1.035/26.29	0.70/19.85	1.035/26.29	0.82/23.25	
BNC Male	1.286/32.66	0.89/25.23	0.800/20.32	0.36/10.21	0.800/20.32	0.35/9.92	D.C.-1.000
BNC Female	1.155/29.34	0.62/17.58	0.900/22.86	0.25/7.09	0.900/22.86	0.21/5.95	
TNC Male	1.255/31.88	1.02/29.92	0.770/19.56	0.51/14.45	0.770/19.56	0.50/14.18	D.C.-15,000
TNC Female	1.155/29.34	0.92/26.08	0.900/22.86	0.20/5.67	0.900/22.86	0.18/5.10	
SMA Male	0.875/22.23	0.16/4.54	0.445/11.30	0.07/1.98	0.435/11.05	0.08/2.03	D.C.-26,000
SMA Female	0.875/22.23	0.13/3.69	0.500/12.7	0.09/2.55	0.500/12.7	0.10/2.86	

ORDERING INFORMATION ON "IN-A-CABLE" FILTERS

The following information is required for a typical Micro-Coax Low-Pass, Bandpass, or High-Pass Filter application:

1. Diameter of semi-rigid cable. Bandpass and High-Pass Filters are avilable only in 0.141" (3.58mm) diameter cable. Low-Pass Filters are available in 0.141" (3.58mm), 0.0865" (2.20mm), and 0.250"(6.35mm) cable diameters.
2. Select a model number.

Explanation of Bandpass Filter Number Code

UT†† BP — 141A — XXXXX/XXXXX — X
1 2 3 4 5 6

1) Micro-Coax Components, Inc.; 2) BP = Bandpass; 3) 0.141" (3.58mm) Diameter; 4) Lower Passband Frequency, MHz; 5) Upper Passband Frequency, MHz; 6) Number of Resonators

Explanation of Low-Pass Filter Number Code

UT L X — XXXX — XXXXX — XX
1 2 3 4 5 6

1) Micro-Coax Components, Inc.; 2) L = Low-Pass; 3) I = Inductive Input; C = Capacitive Input; H = Frequency below 2000 MHz; 4) Diameter of Filter [(85 = 0.085" (2.16mm); 141A = 0.141" (3.58mm); 250A = 0.250" (6.35mm)]; 5) Highest Passband Frequency, MHz; 6) Number of Sections (Reactive Elements)

Explanation of High-Pass Filter Number Code

UT HP — 141A — XXXX — X
1 2 3 4 5

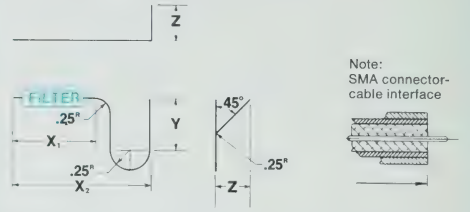
1) Micro-Coax Components, Inc.; 2) HP = High-Pass 3) 0.141" (3.58mm) Diameter; 4) Lowest Passband Frequency, MHz; 5) Number of Sections (Reactive Elements)

3. To designate a male and female connector of any one series, add the suffix N, BNC, TNC, or SMA to the model number. Standard connector lengths are provided in the Connector Option Guide above. For other connector requirements, contact Micro-Coax Components.
4. Specify additional straight lengths (up to 2 feet - 0.6096m -on each end) if desired. In this configuration, the filter area will be marked with heat-shrink tubing for easy identification and location. Beyond this marked area required for filter protection and packaging, the semi-rigid cable may be soldered, cut stripped, and bent within the following minimum inside bending radii: UT 85, 0.125" (3.18mm); UT 141A, 0.250" (6.35mm); and UT 250, 0.375 (9.53mm).
5. To specify a cable assembly including an integral filter, select an appropriate filter model number, note the minimum straight length and

- Use the center line technique shown below to achieve the optimum layout, locating the filter in a straight section equal to, or greater than, the minimum straight length of the model number desired.
- Use the largest practical minimum **inside bend radius** possible to optimize electrical performance.
- Maintain constant bend radii on all bends to reduce tooling costs.
- Specify SWR, phase matching, insertion loss, rejection, testing level over the band of interest only, since excess specifications increase costs.
- To prevent procurement delays, do not specify connectors by brand name unless absolutely necessary.

6. If the Micro-Coax "In-A-Cable" Filters listed in this catalog do not coincide with your requirement, complete technical assistance with your application is available from the engineering staff of Micro-Coax Components, Inc.

MICRO-COAX "IN-A-CABLE" FILTERS
where minimum straight length is not greater than X_1.

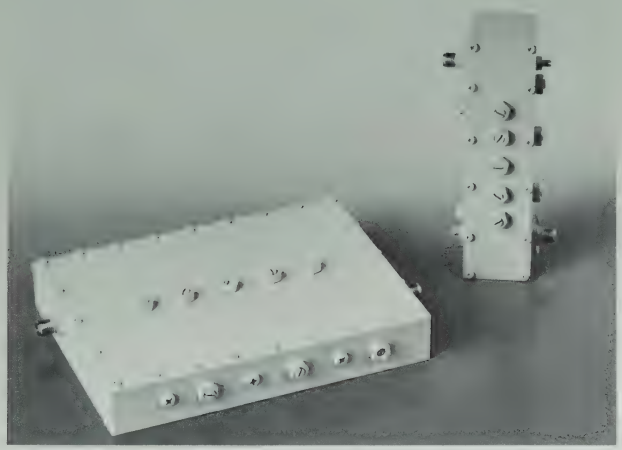


Dimension to cable center line in all cases is necessary, and from cable interface with connector where practical. Detail connector if interface dimension is not given.

Using the center line technique helps achieve optimum layout for "In-A-Cable" designs.

†† Registered trademark of UTI Corporation

HUBER + SUHNER RF AND MICROWAVE FILTERS
Series 2100 Coaxial Bandpass Filters



Suhner Series 2100 Bandpass Filters are interdigital filters with coaxial SMA or N connectors. They are very compact and cover a wide range of bandwidths from 1% to 40%. Very favorable insertion loss figures can be achieved because dielectric supports are not utilized.

The typical Series 2100 Bandpass Filters listed below, although not available from stock, can be supplied on short notice. No design charge is involved unless custom design is required.

TYPICAL SUHNER BANDPASS COAXIAL FILTERS, SERIES 2100 (Continued on the next page)

Suhner Part Number	Center Frequency (MHz)	Ripple Bandwidth (MHz)	Number of Sections	SWR	Insertion Loss (dB) (1)	Stopband Attenuation (dB)	Stopband Attenuation Center Frequency (± MHz)	Connectors (2 Female)	Dimensions (inches [mm])
2100.19.A	500	60	6	1.15:1	0.25	60	100	SMA	4.72 x 6.10 x 0.98 120 x 1
2100.17.B	137.5	3.5	3	1.15:1	0.5	30 45	+10 -15	N	22.7 x 6.30 x 1.34 576 x 160 x 34
2100.17.C	160	2	3	1.15:1	1.0	30 45	+10 -15	N	20.4 x 6.30 x 1.34
2101.19.A	1100	48	6	1.15:1	1.0	60	100	SMA	4.92 x 2.96 x 0.79
2101.19.C	1480	300	6	1.2:1	0.3	60 30	+500 -500	SMA	4.13 x 2.20 x 0.79
2101.19.D	900	45	6	1.15:1	1.2	60	100	SMA	5.67 x 3.62 x 0.79
2101.19.F	1200	600	6	1.2:1	0.4	30 50	+600 -800	SMA	2.76 x 66.0 x 0.79
2101.19.K	1050/950	100	8	1.2:1	0.8	30	80	SMA	6.61 x 3.39 x 0.94
2101.19.L	1250	300	8	1.2:1	0.4	30	250	SMA	2.68 x 5.36 x 0.94
2102.17.B	2250	113	7	1.2:1	1.5	60	150	N	4.57 x 1.66 x 0.71 116 x
2102.19.A	1700	30	6	1.15:1	1.0	60	50	SMA	5.31 x 1.97 x 0.79
2102.19.B	2200	400	6	1.2:1	0.5	30	450	SMA	2.17 x 1.58 x 0.60 55 x
2102.19.C	1500	1000	6	1.25:1	0.5	30	1000	SMA	2.29 x 2.29 x 0.79
2102.19.K	1450/1550	100	8	1.2:1	1.0	30	80	SMA	7.24 x 2.37 x 0.94 184 x
2102.19.L	1800	400	8	1.2:1	0.4	30	350	SMA	1.97 x 5.51 x 0.94 50 x
2102.19.M	2050/2150	100	8	1.2:1	1.4	30	80	SMA	7.71 x 1.73 x 0.94 196 x 44 x 24
2102.19.N	1680	40	6	1.15:1	1.0	60	50	SMA	5.60 x 2.04 x 0.79 14

(1) If required, insertion loss can be improved by a factor of 2 through the use of silver plating. Specified insertion loss is valid over the entire ripple bandwidth. Insertion loss at center frequency will be up to 50% lower.

All data provided are typical values

Micro-Coax Components, Inc., Box E, Collegeville, Pa. 19426, U.S.A. ☐ 215/489-3700

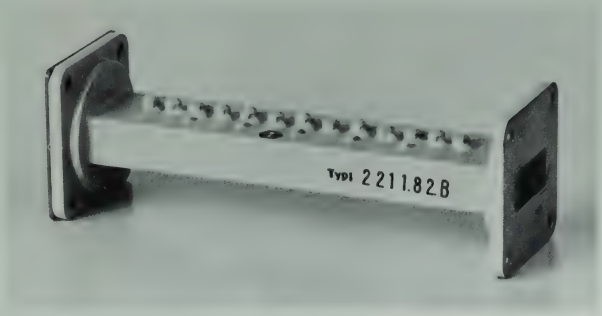
TYPICAL SUHNER BANDPASS COAXIAL FILTERS, SERIES 2100

Suhner Part Number	Center Frequency (MHz)	Ripple Bandwidth (MHz)	Number of Sections	SWR	Insertion Loss (dB) (1)	Stopband Attenuation (dB)	Stopband Attenuation Center Frequency (± MHz)	Connectors (2 Female)	Dimensions (inches/mm)
2103.19.A	2500	400	6	1.15:1	0.25	60	700	SMA	3.00 x 1.38 x 0.71 76 x 35 x 18
2103.19.B	3100	600	6	1.2:1	0.5	30	700	SMA	2.17 x 1.19 x 0.59 55 x 30 x 15
2103.19.E	2650	900	4	1.15:1	0.25	30	1500	SMA	1.41 x 2.51 x 0.79 36 x 64 x 20
2104.19.A	3950	500	6	1.15:1	0.8	60	800	SMA	2.51 x 1.02 x 0.56 64 x 26 x 14
2104.19.B	4200	60	6	1.15:1	1.5	60	100	SMA	3.34 x 0.98 x 0.56 85 x 25 x 14
2104.19.D	3575	250	8	1.2:1	1.0	60	450	SMA	3.54 x 1.10 x 0.56 90 x 28 x 14
2104.19.G	3600	140	6	1.15:1	1.0	60	250	SMA	4.18 x 1.10 x 0.71 106 x 28 x 18
2104.19.H	4320	220	6	1.15:1	0.8	60	400	SMA	3.93 x 1.02 x 0.71 100 x 26 x 18
2105.19.A	5200	600	6	1.2:1	0.35	30	800	SMA	0.03 x 0.79 x 0.59 60 x 20 15
2105.19.C	5250	450	6	1.15:1	0.5	30	450	SMA	2.76 x 0.87 x 0.55 70 x 22 x 14
2106.19.A	6200	550	6	1.15:1	0.6	30 50	+500 -800	SMA	2.68 x 0.79 x 0.55 68 x 20 x 14
2106.19.B	6835	100	8	1.2:1	3.0	45 45	+150 -150	SMA	8.34 x 0.67 x 0.79 212 x 17 x 20
2106.19.C	6600	800	6	1.2:1	0.7	30	800	SMA	2.37 x 0.71 x 0.59/60 x 18 x 15
2106.19.D	5900	250	6	1.2:1	1.2	40 60	+250 -380	SMA	3.07 x 0.79 x 3.07/78 x 20 x 15
2106.19.E	5970	100	4	1.2:1	1.2	20	130	SMA	4.09 x 0.79 . 0.79/104 x 20 x 20
2107.19.A	7200	550	6	1.15:1	0.6	30	500	SMA	2.76 x 0.71 x 0.55/70 x 18 x 14
2108.19.A	8500	1000	6	1.2:1	0.6	20	1000	SMA	2.37 x 0.59 x 0.59/60 x 15 x 15
2109.19.A	9000	1000	6	1.2:1	0.6	60	1600	SMA	2.68 x 0.62 x 0.55/68 x 16 x 14
2109.19.B	9000	2000	3	1.2:1	0.3	20 at 40 at	6000 4000	SMA	1.46 x 0.55 x 0.67/37 x 14 x 17
2110.19.D	10,050	100	4	1.15:1	1.5	40	500	SMA	3.60 x 0.62 x 0.55/66 x 16 x 14
2110.19.G	10,300	1000	6	1.2:1	0.8	60	1600	SMA	2.68 x 0.62 x 0.55/68 x 16 x 14
2110.19.F	10,221	350	4	1.2:1	1.0	40	800	SMA	2.29 x 0.62 x 0.55/58 x 16 x 14
2111.19.B	11,325	750	4	1.25:1	1.0	20	1000	SMA	2.04 x 0.55 x 0.55/52 x 14 x 14
2111.19.C	10,560	350	4	1.2:1	1.0	50	1200	SMA	2.29 x 0.62 x 0.55/58 x 16 x 14
2112.19.A	11,950	500	6	1.2:1	0.8	60	1000	SMA	2.17 x 0.47 x 0.39/55 x 12 x 10
2112.19.B	12,050/11,300	900	6	1.2:1	1.0	40 60	+1000 -1500	SMA	2.68 x 0.47 x 0.55/68 x 12 x 14

(1) If required, insertion loss can be improved by a factor of 2 through the use of silver plating. Specified insertion loss is valid over the entire ripple bandwidth. Insertion loss at center frequency will be up to 50% lower.

All data provided are typical values.

HUBER + SUHNER RF AND MICROWAVE FILTERS
Series 2200 Waveguide Bandpass Filters



Suhner Series 2200 Waveguide Bandpass Filters are based on the inductive post design. This permits use of standard waveguide sections so that customer specifications can be produced quickly.

TYPICAL SUHNER WAVEGUIDE BANDPASS FILTERS, SERIES 2200

Suhner Part Number	Center Frequency (MHz)	Ripple Bandwidth (MHz)	Number of Sections	SWR	Insertion Loss (dB) (1)	Stopband Attenuation (dB)	Stopband Attenuation Center Frequency (± MHz)	Waveguide Size	Flange	Length (inches [mm])
2206.84.B	6480	140	5	1.1:1	0.4	50	400	WR137	UAR70	7.24 [184]
2206.84.C	6790	360	5	1.1:1	0.2	50	+1000 -600	WR137	UAR70	6.581 [167]
2206..84.D(2)	6480	40	6	1.2:1	3.0	50	70	WR137	UAR70	8.47 [215]
2207.88.A(2)	7239	30	5	1.2:1	2.5	60	70	WR112	PBR84/SMA	8.27 [210]
2207.88.D(2)	7220/7340	40	8	1.2:1	4.0	55	60	WR112	UBR84	10.9 [277]
2208.88.A	8100	600	6	1.1:1	0.4	50 50	+1300 -800	WR112	UBR84	6.46 [164]
2211.82.A	11.300	800	6	1.15:1	0.4	50 50	+1700 -1000	WR90	UBR100	4.76 [121]
2211.83.A	11.090	400	6	1.2:1	1.0	60	1000	WR75	UBR120	5.51 [140]
2212.00.A	12.000	150	6	1.15:1	2.0	60	300	WR75	UBR120/SMA	5.62 [143]
2212.19.B(2)	11.550	35	4	1.15:1	2.5	50	140	WR75	SMA neg	5.08 [129]
2212.83.A	11.900	600	6	1.1:1	0.75	60 60	+1600 -1000	WR75	UBR120	4.92 [125]
2212.83.B	12.625	300	6	1.15:1	1.4	50 50	+600 -500	WR75	UBR120	4.97 [126]
2212.83.C	12.090	400	6	1.2:1	1.0	60	1000	WR75	UBR120	5.98 [152]
2213.83.A	12.775	550	6	1.15:1	0.4	50	1000	WR75	UBR120	4.33 [110]
2214.81.A	14.250	600	6	1.1:1	0.6	60 60	+1300 -1000	WR62	UBR140	4.09 [104]
2217.81.A	17.300	150	4	1.2:1	2.5	60	600	WR62	UBR140	2.68 [68]
2219.80.A	19.450	1000	6	1.15:1	0.5	40 40	+1800 -1000	WR42	UBR220	3.14 [80]
2219.80.C	19.200	800	6	1.15:1	1.0	50 50	+1400 -1000	WR42	UBR220	3.54 [90]
2220.80.A	20.200	1000	6	1.2:1	0.5	50 50	+1800 -1200	WR42	UBR220	3.42 [87]
2230.89.A	29.700	400	4	1.15:1	0.8	30 30	+1000 -900	WR28	UBR320	1.89 [48]

(1) If required, insertion loss can be improved by a factor of 2 through the use of silver plating. Specified insertion loss is valid over the entire ripple bandwidth. Insertion loss at center frequency will be up to 50% lower

(2) Invar, rather than brass, filter

All data provided are typical values

HUBER + SUHNER RF AND MICROWAVE FILTERS
Series 2000 Coaxial Low-Pass Filters

Suhner Series 2000 Coaxial Low-Pass Filters are designed for test and measurement applications as well as use in microwave systems. The filters are dimensioned for the ideal balance between passband SWR, first spurious resonance, and overall length. SMA or N types of connectors are used if male/female is not specified.

As well as these standard coaxial low-pass filters, Suhner can design and produce filters to customer specifications.

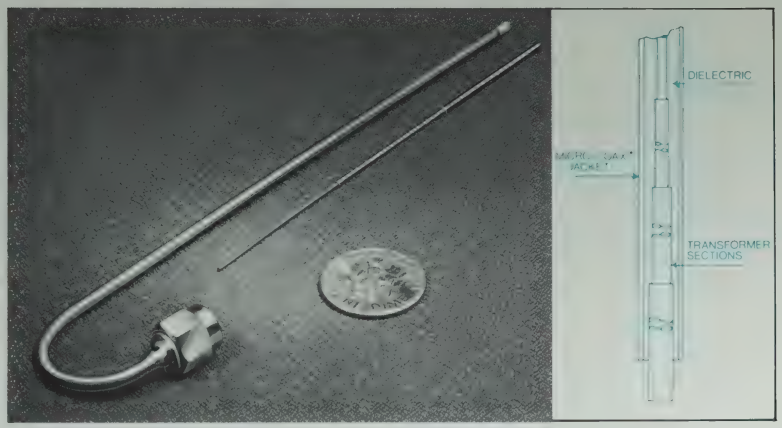
STANDARD SUHNER COAXIAL LOW-PASS FILTERS, SERIES 2000

Suhner Part Number	Cutoff Frequency (GHz)	60 dB Attenuation at (GHz)	Number of Sections	Connector (Type)	First Spurious Response (>GHz)	SWR (1) (≤)	Insertion Loss (≤ dB)	Dimensions (inches / mm)
2001.19.A	1.0	1.6	11	SMA	5	1.20:1	0.15	7.88 / 200
2001.17.A	1.0	1.6	11	N	5	1.20:1	0.15	9.72 / 247
2003.19.A	2.5	4.5	11	SMA	15	1.20:1	0.15	5.11 / 130
2003.17.A	2.5	4.5	11	N	15	1.20:1	0.15	6.97 / 177
2005.19.A	4.8	7.5	13	SMA	20	1.20:1	0.2	4.40 / 112
2005.17.A	4.8	7.5	13	N	20	1.20:1	0.2	6.26 / 159
2007.19.A	6.8	9.5	15	SMA	20	1.25:1	0.2	3.03 / 77
2007.17.A	6.8	9.5	15	N	20	1.25:1	0.2	4.89 / 124
2009.19.A	9.5	13.5	15	SMA	30	1.25:1	0.25	2.76 / 70
2009.17.A	9.5	13.5	15	N	30	1.25:1	0.25	4.61 / 117
2013.19.A	13.0	18.0	15	SMA	34	1.25:1(2)	0.25	2.32 / 59
2013.17.A	13.0	18.0	15	N	34	1.25:1(2)	0.25	4.18 / 106

(1) Frequency is less than, or equal to, 0.85 x cutoff frequency
(2) 125:1 up to 8 GHz; 1.5:1 up to 13 GHz

MICRO-COAX Z_0 TRANSFORMER CABLE* AND CABLE ASSEMBLIES

Impedance transformers can now be integrated within both standard and non-standard diameter semi-rigid coaxial cables and cable assemblies. What is unique about Micro-Coax Impedance Transformer Cables is not the well-known electrical design of cascaded quarter-wave impedance transformers, but the technique of integrating the transformers within a continuous section of semi-rigid cable jacket.



FEATURES

- Reduced space and weight requirements.
- Eliminates up to four connectors when integrated in a conventional semi-rigid cable assembly.
- Monolithically sealed unit.
- High reliability.
- Reduced cost over conventional rigid tubular equivalent.

APPLICATIONS

- Interface between low Z_o solid state sources and standard 50 ohm or 75 ohm systems.
- Feeding of antennas or antenna array elements with Z_o higher or lower than standard 50 ohm or 75 ohm systems.
- Interface between 50 ohm and 75 ohm systems.
- N-way power dividers.
- Custom requirements.

TECHNICAL DATA

Refer to Tables I through IV on the reverse side to determine the minimum number of quarter-wave sections, N, to meet a maximum SWR of 1.25:1, 1.5:1, 2.0:1 or 3.0:1 respectively. To use these tables, calculate the fractional bandwidth from the lowest and highest operating frequencies, F_l and F_h respectively, and the impedance ratio Z_h/Z_l from the lowest and highest input/output characteristic impedances, Z_l and Z_h respectively. Next, depending on the desired maximum SWR, select the appropriate Table I, II, III or IV on the following page and find the fractional bandwidth and impedance ratio which most closely matches your requirement. If this value falls between those given in the table, choose the next largest rather than the next smallest. The minimum number of quarter-wave sections, N, is then given by the intersection of the bandwidth row and the impedance ratio column. The approximate total length, L, of the impedance transformer sections is then given by

$$L = \frac{N \times 5.904}{F_l + F_h} \sqrt{e}$$ e = dielectric constant.

where F_l and F_h are given in GHz. Additional lengths of cable can be specified at either end of the straight length L to form a custom semi-rigid impedance transformer cable assembly. Standard connectors can be supplied when available for the impedance required at transformer terminations.

*Patent 4,161,704

DESIGN EXAMPLE

An impedance transformer is required from 50 to 10 ohms with an operating frequency range of 8 GHz to 18 GHz and a SWR of 1.25:1

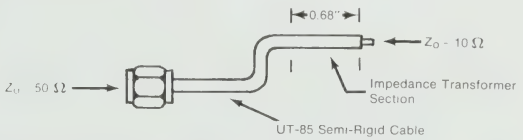
$$\text{Bandwidth} = \frac{2(18 - 8)}{18 + 8} = 0.769, \text{ use } 0.8$$

$$Z_h/Z_l = \frac{50}{10} = 5$$

Using Table I the minimum number of sections is 3.

$$L = \frac{3 \times 5.904}{8 + 18} = 0.68''$$

Hence this impedance transformer can be fabricated in less than one inch of semi-rigid cable with a 10 ohm characteristic impedance at one end, and 50 ohms at the other. In addition, if UT 85 cable was selected, bends with radii as small as 0.125" could be supplied beyond the immediate area of the transformer sections which must be straight, and a standard SMA connector can be attached to the 50 ohm end. See diagram below:



Semi-Rigid Impedance Transformer Cable Assembly

TABLE 1

Minimum Number of Quarter-Wave Sections Required for 1.25:1 Maximum* SWR.

BANDWIDTH $\frac{2(F_h-F_l)}{F_h+F_l}$	IMPEDANCE RATIO, $\left(\frac{Z_h}{Z_l}\right)$								
	1.25	1.50	2.0	3.0	5.0	10.0	15.0	20.0	25.0
0.2	1	1	1	1	2	2	2	2	2
0.4	1	1	2	2	2	2	2	3	3
0.6	1	1	2	2	3	3	3	3	3
0.8	1	2	2	3	3	4	4	4	4
1.0	1	2	3	3	4	4	5	6	6
1.2	1	3	3	4	6	6	7	7	7

TABLE II

Minimum Number of Quarter-Wave Sections Required for 1.5:1 Maximum* SWR.

BANDWIDTH $\frac{2(F_h-F_l)}{F_h+F_l}$	IMPEDANCE RATIO, $\left(\frac{Z_h}{Z_l}\right)$								
	1.25	1.50	2.0	3.0	5.0	10.0	15.0	20.0	25.0
0.2	1	1	1	1	1	2	2	2	2
0.4	1	1	1	1	2	2	2	2	2
0.6	1	1	1	2	2	2	3	3	3
0.8	1	1	2	2	3	3	3	3	3
1.0	1	1	2	3	3	4	4	4	4
1.2	1	1	2	3	4	5	6	6	6

TABLE III

Minimum Number of Quarter-Wave Sections Required for 2.0:1 Maximum* SWR.

BANDWIDTH $\frac{2(F_h-F_l)}{F_h+F_l}$	IMPEDANCE RATIO, $\left(\frac{Z_h}{Z_l}\right)$								
	1.25	1.50	2.0	3.0	5.0	10.0	15.0	20.0	25.0
0.2	1	1	1	1	1	1	1	2	2
0.4	1	1	1	1	1	2	2	2	2
0.6	1	1	1	1	2	2	2	2	2
0.8	1	1	1	2	2	2	3	3	3
1.0	1	1	1	2	2	3	3	3	4
1.2	1	1	1	2	3	4	4	4	4

TABLE IV

Minimum Number of Quarter-Wave Sections Required for 3.0:1 Maximum* SWR.

BANDWIDTH $\frac{2(F_h-F_l)}{F_h+F_l}$	IMPEDANCE RATIO, $\left(\frac{Z_h}{Z_l}\right)$								
	1.25	1.50	2.0	3.0	5.0	10.0	15.0	20.0	25.0
0.2	1	1	1	1	1	1	1	1	1
0.4	1	1	1	1	1	1	2	2	2
0.6	1	1	1	1	1	2	2	2	2
0.8	1	1	1	1	1	2	2	2	2
1.0	1	1	1	1	2	2	3	3	3
1.2	1	1	1	1	2	3	3	4	4

*This represents a theoretical maximum, exclusive of additional reflections caused by connectors, terminations and test fixtures

TECHNICAL ASSISTANCE

Complete technical assistance for your custom semi-rigid impedance transformer requirements is available from the engineering staff at Micro-Coax Components, Inc.

ORDERING INFORMATION: The following information is required for a typical impedance transformer application:

1. Diameter of semi-rigid cable. Choose from Micro-Coax and special Semi-Rigid Cable sizes.
2. Specify operating frequency range.
3. Specify the input and output characteristic impedances. Minimum and maximum standard impedances are 5 ohms and 110 ohms respectively.
4. Specify maximum SWR.
5. Specify connectors, if required, and sketch of the assembly desired. The technical data section on page 59 will help you determine the approximate length of the impedance transformer section. In general, it is not practical to provide connectors for non-standard impedances. In such cases, a direct solder connection is recommended.

SECTION 5

MILLIMETER WAVEGUIDE AND WAVEGUIDE ASSEMBLIES

The emergence of millimeter waveguide technology has created a need for waveguide tubing of the highest quality and close manufacturing tolerance.

Products listed are all manufactured on specialized equipment designed and built by Micro-Coax Components, Inc., and are representative of the finest manufacturing techniques and equipment technology available in the world.

All products are designed in accordance with MIL-W-85/3A. Special care is taken to provide smooth surface finishes for lower insertion loss, and exacting corner radii.

General Specifications

Materials:

Copper: Type DLP (Alloy 120) per ANSI/ASTM B-372.
Copper Alloy: Commercial Bronze (Alloy 220) per ANSI/ASTM B-372.
Silver Alloy: Grade C, MIL-S-13282 (coin silver).
Aluminum: Alloy 1100 per ANSI/ASTM B-210.

Temper: As drawn

Internal Surface: Measured per 4. 6. 5. of MIL-W-85.

- 32 Microinches RMS maximum for copper, copper alloy and silver alloy.
- 63 Microinches RMS maximum for aluminum.

Perpendicularity:

Deviation from right angle formed by 2 adjacent interior surfaces not to exceed .008 inch per inch (½ degree) at each end of manufactured length.

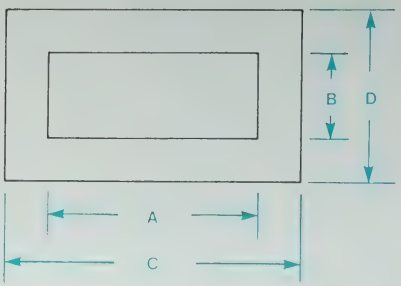
Bow:

Measured per 4. 6. 2. of MIL-W-85.
Not to exceed .010 inch per 24 inch in narrow surface, and .020 inch per 24 inch in wide surface.

Twist:

Measured per 4. 6. 3. of MIL-W-85.
Not to exceed 1 degree per foot.

UT†† MILLIMETER WAVEGUIDE SPECIFICATIONS



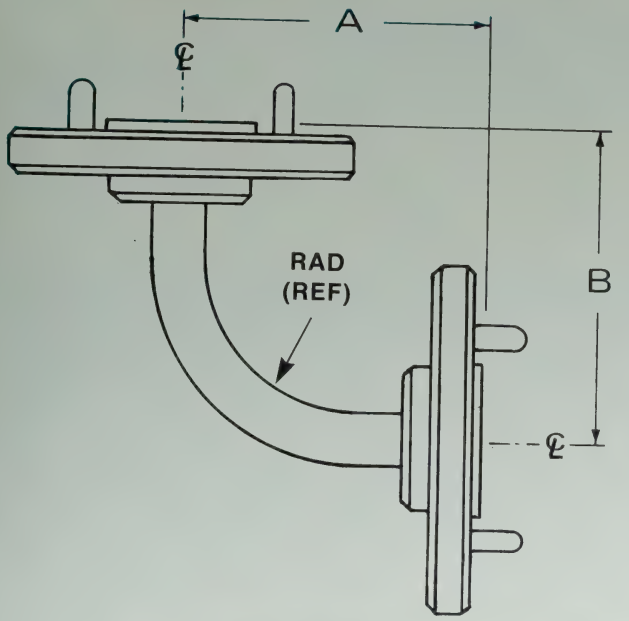
WR NUMBER	SUGGESTED FREQUENCY RANGE TE_{10} MODE GHz	INSIDE DIMENSIONS			THEORETICAL[1] ATTENUATION (lowest to highest frequency) dB/100 ft.
		Width (A)	Height (B)	Tolerance	
WR28	26.50—40.00	.2800 (7.11)	.1400 (3.56)	± .0015 (.04)	24.55—16.80 Silver 23.02—15.77 Copper
WR22	33.00—50.00	.2240 (5.69)	.1120 (2.84)	± .0010 (.03)	34.57—23.50 Silver 32.44—22.05 Copper
WR19	40.00—60.00	.1880 (4.78)	.0940 (2.39)	± .0010 (.03)	42.39—30.46 Silver 39.81—28.60 Copper
WR15	50.00—75.00	.1480 (3.76)	.0740 (1.88)	± .0010 (.03)	64.23—43.89 Silver 60.25—41.17 Copper
WR12	60.00—90.00	.1220 (3.10)	.0610 (1.55)	± .0010 (.03)	87.79—58.86 Silver 82.37—55.22 Copper
WR10	75.00—110.00	.1000 (2.54)	.0500 (1.27)	± .0010 (.03)	112.5—79.26 Silver 105.6—74.37 Copper
WR8	90.00—140.00	.0800 (2.03)	.0400 (1.02)	± .0005 (.01)	171.4—110.0 Silver 160.0—103.3 Copper
WR7	110.00—170.00	.0650 (1.65)	.0325 (.83)	± .0005 (.01)	238.1—150.9 Silver 223.5—141.7 Copper
WR5	140.00—220.00	.0510 (1.30)	.0255 (.65)	± .0005 (.01)	343.6—216.0 Silver 322.7—202.8 Copper
WR4	170.00—260.00	.0430 (1.09)	.0215 (.55)	± .0005 (.01)	428.2—283.2 Silver 402.0—265.9 Copper
WR3	220.00—325.00	.0340 (.86)	.0170 (.43)	± .0005 (.01)	570.9—388.0 Silver 536.0—364.4 Copper

1 — At 20°C waveguide temperature.

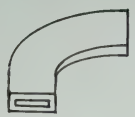
WR NUMBER	OUTSIDE DIMENSIONS			Max. Inner CORNER RADIUS	WALL		MAX. I.D. SCRATCH DEPTH[2]	MAXIMUM MANUFACTURED LENGTH. FT. (M)
	Width (C)	Height (D)	Tolerance		Nom. Thkns.	Max. Ecc.[1]		
WR28	360 (9.14)	.220 (5.59)	± .002 (.05)	.008 (.20)	.040 (1.02)	.002 (.05)	.0034 (.086)	14 (4.27)
WR22	304 (7.72)	.192 (4.88)	± .002 (.05)	.007 (.18)	.040 (1.02)	.002 (.05)	.0027 (.069)	14 (4.27)
WR19	268 (6.81)	.174 (4.42)	± .002 (.05)	006 (.15)	.040 (1.02)	.002 (.05)	.0023 (.058)	14 (4.27)
WR15	228 (5.79)	.154 (3.91)	± .002 (.05)	.006 (.15)	.040 (1.02)	.002 (.05)	.0018 (.046)	14 (4.27)
WR12	202 (5.13)	.141 (3.58)	± .002 (.05)	.006 (.15)	.040 (1.02)	.002 (.05)	.0015 (.038)	14 (4.27)
WR10	180 (4.57)	.130 (3.30)	± .002 (.05)	.006 (.15)	.040 (1.02)	.002 (.05)	.0010 (.025)	14 (4.27)
WR8	120 (3.05)	.080 (2.03)	± .001 (.03)	.006 (.15)	.020 (.51)	.0015 (.04)	.0010 (.025)	4 (1.22)
WR7	.105 (2.67)	.0725 (1.83)	± .001 (.03)	.006 (.15)	.020 (.51)	.0015 (.04)	.0010 (.025)	4 (1.22)
WR5	091 (2.31)	.0655 (1.65)	± .001 (.03)	.006 (.15)	.020 (.51)	.0015 (.04)	.0010 (.025)	4 (1.22)
WR4	083 (2.11)	.0615 (1.55)	± .001 (.03)	.006 (.15)	.020 (.51)	.0015 (.04)	.0010 (.025)	4 (1.22)
WR3	074 (1.88)	.057 (1.45)	± .001 (.03)	.006 (.15)	.020 (.51)	.0015 (.04)	.0010 (.025)	4 (1.22)

1 - Defined as ½ the difference between opposite wall thicknesses, measured at any cross-section normal to long axis.
2 - Measured per 4. 6. 8 of MIL-W-85G
NOTE: All dimensions are in inches (MM) unless otherwise shown

†† Registered trademark of UTI Corporation



"E" PLANE



"H" PLANE

Millimeter Waveguide Assemblies

WG Number	JAN WG Number	MIL-W-85/3A Number	Frequency (GHz)	Brass Flanges (MIL-F-3922/67B-XXX)	Inside Bend Radius		Dimension A	Dimensions B
					E Plane (inches/mm)	H Plane (inches/mm)	Minimum (inches/mm)	Minimum (inches/mm)
WR28	RG 96U	006/009	26.5-40.0	-005	0.50/12.7	0.50	1	1
WR22	RG 97U	010/013	33.0-50.0	-006	0.50/12.7	0.50	1	1
WR19	RG 358U	014/016	40.0-60.0	-007	0.50/12.7	0.50	1	1
WR15	RG 98U	017/019	50.0-75.0	-008	0.50/12.7	0.50/12.7	1/25.4	1/25.4
WR12	RG 99U	020/022	60.0-90.0	-009	0.50/12.7	0.50/12.7	1	1
WR10	RG 359U	023/025	75.0-110.0	-010	0.50/12.7	0.50/12.7	1	1
WR8	RG 138U	041/043	90.0-140.0	-001 *	0.25/6.35	0.25/6.35	0.95/24.13	0.95
WR7	RG 136U	044/046	110.0-170.0	-002 *	0.25/6.35	0.25/6.35	0.95/24.13	0.95/24.1
WR5	RG 135U	047/049	140.0-220.0	-003 *	0.25	0.25	0.95	0.95
WR4	RG 137U	050/052	170.0-260.0	-004 *	0.25/6.35	0.25/6.35	0.95/24.13	0.95
WR3	RG 139U	053/055	220.0-325.0	-005 *	0.25/6.35	0.25/6.35	0.95/24.13	0.95

* Flanges designed in accordance with MIL-F-3922/74 except flange ID dimension altered to accept 0.020" (0.508 mm) WG wall in lieu of 0.040" (1.16 mm)

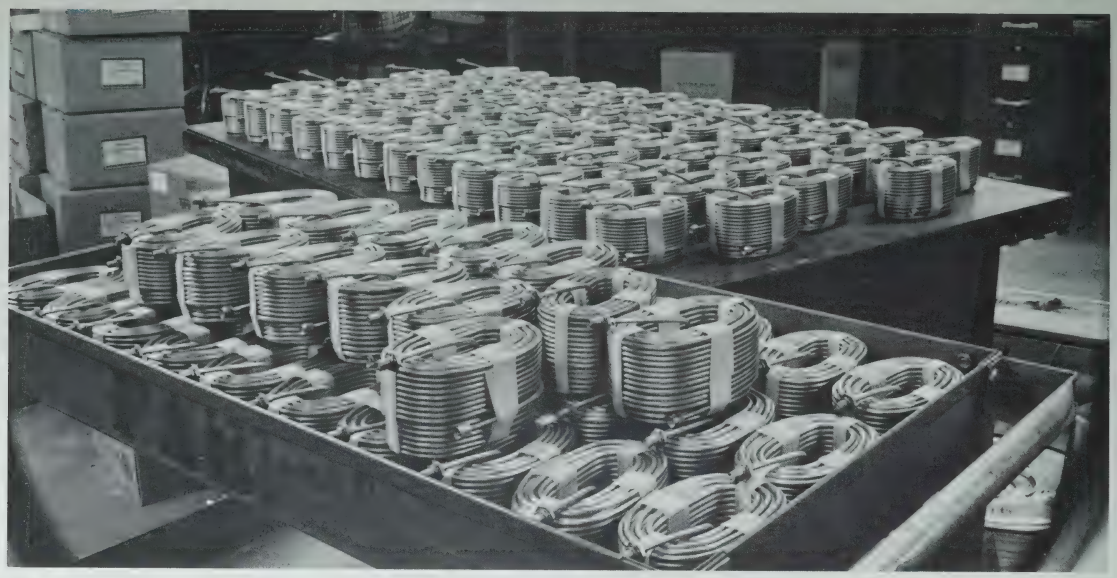
SECTION 6
COAXIAL AND WAVEGUIDE DELAY LINES

Micro-Coax Delay Lines are a highly reliable method of providing short delays in RF and microwave signals. Short interval delays are used for such purposes as:

- Generation of discrete phase changes
- Achieving pulse compression radar
- Calibration of microwave altimeters
- Attaining a loop circuit in an ECM system

Micro-Coax Delay Lines are available in standard configurations as shown in the Specification table on page 65, or designed to meet specific package or delay parameters required by the system.

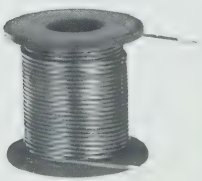
The standard units are available in cable sizes ranging from UT†† 34 through UT 250A and offer delays of 5, 10, 25, 50, and 100 nanoseconds which are ideal for breadboard and other production applications.



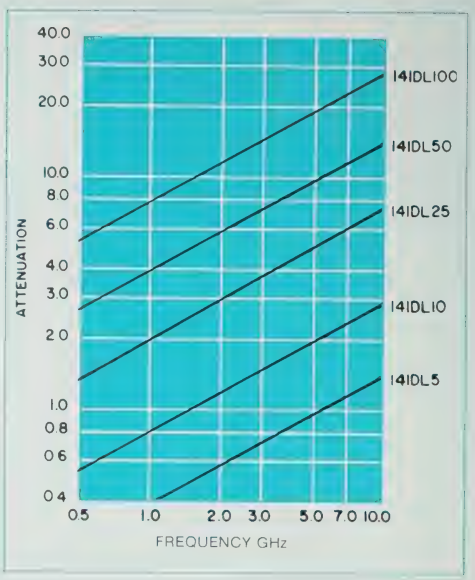
Coaxial delay lines

UT 85-DL25.

UT250 delay line.



UT 34-DL25.

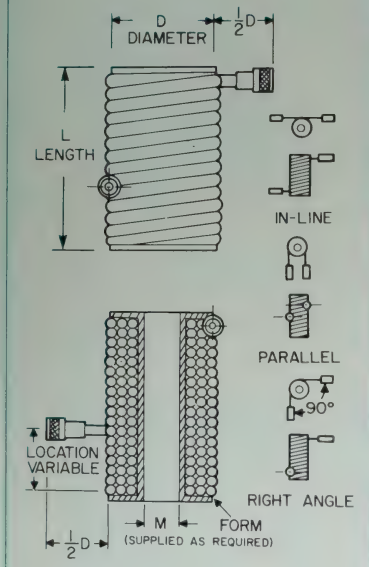


Typical attenuation for 0.141" Micro-Coax Delay Lines

Micro-Coax Components, Inc., Box E, Collegeville, Pa. 19426, U.S.A. ☐ 215/489-3700

†† Registered trademark of UTI Corporation

SPECIFICATIONS OF MICRO-COAX DELAY LINES



Micro-Coax Delay Lines	Delay* (ns)	Micro-Coax Part Number	Dimensions (inches/mm) Maximum L	D	M	Weight (ounces/gr)	Cable Length (ft/m)
Miniature							
34DL Series	5	34DL5	1/25.4	1/25.4	0.5/12.7	1.5/42.53	3.5/0.457
	10	34DL10	1/25.4	1/25.4	0.5/12.7	2/56.7	7.0/0.610
0.034" (0.86mm) OD	25	34DL25	1/25.4	1.25/31.75	0.5/12.7	2.25/63.79	17.5/5.334
UT 34	50	34DL50	1/25.4	1.25/31.75	0.5/12.7	3.25/92.14	35.0/10.67
Micro-Coax Cable							
Compact							
85DL Series	5	85DL5	1.25/31.75	1.75/44.45	1/25.4	2.5/70.88	3.5/0.457
	10	85DL10	1.25/31.75	1.75/44.45	1/25.4	3.5/99.23	7.0/0.610
0.085" (2.16mm) OD	25	85DL25	2.25/57.15	1.75/44.45	1/25.4	7/198.5	17.5/5.334
UT 85	50	85DL50	2.25/57.15	2.25/57.15	1/25.4	14/396.9	35.0/10.67
Micro-Coax Cable							
General Purpose							
141DL Series	5	141DL5	1.75/44.45	2.25/57.15	1.5/38.1	4/113.4	3.5/0.457
	10	141DL10	3/77.1	2.25/57.15	1.5/38.1	8/226.8	7.0/0.610
0.141" (3.58mm) OD	25	141DL25	4.75/120.7	2.50/63.5	1.5/38.1	14/396.9	17.5/5.334
UT 141	50	141DL50	4.75/120.7	2.50/63.5	1.5/38.1	20/567.0	35.0/10.67
Micro-Coax Cable	100	141DL100	6.25/158.8	3/76.2	1.5/38.1	35/992.3	70.0/21.34
Low Loss							
250DL Series	5	250DL5	2/50.8	5.5/139.7	4/101.6	8/226.8	3.5/0.457
	10	250DL10	3/76.2	5.5/139.7	4/101.6	14/396.8	7.0/0.610
0.250" (6.35mm) OD	25	250DL25	3.50/88.9	5.5/139.7	4/101.6	32/907.2	17.5/5.334
UT 250	50	250DL50	5/127	5.5/139.7	4/101.6	60/1701.0	35.0/10.67
Micro-Coax Cable	100	250DL100	9/234.95	5.5/139.7	4/101.6	125/3543.8	70.0/21.34

For 25 ns and below, tolerance is ± 0.5 ns. For 25 ns and above, tolerance is ± 1 ns.

WAVEGUIDE DELAY LINES

Micro-Coax Waveguide Delay Lines are constructed of thin-wall aluminum tubing supported by an alloy casting. Unlike coaxial delay lines, waveguide delay lines are frequency sensitive, thus the delay values change with frequency.

The calculated attenuation properties of X-Band Micro-Coax Delay Lines, when expressed in dB per microsecond, are essentially constant between 8.2 and 12.4 GHz.

The advantages of waveguide delay lines include:

- Greatly reduced loss when compared with coaxial delay lines.
- Longer delays can be generated without intermediate amplification.
- A change in delay characteristics can be utilized to form a pulse compression network (see equation), an advantage that is useful in the calibration of radars, altimeters, and range finding equipment.

Note that waveguide delay lines are larger, weigh more, and cost more than coaxial delay lines.

To compute the length of line necessary to provide a *delay* at a given frequency, use the following equation:

$$Lg = 984 \times T\mu \times \lambda_0/\lambda_g$$

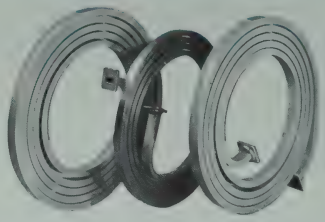
Where: Lg = length of waveguide in feet; 984 = velocity in feet per microsecond; $T\mu$ = the delay in microseconds; λ_0 and λ_g = the free space and waveguide wavelength respectively at the given frequency. Once the delay has been calculated, the attenuation for the delay line can be determined using the following formula:

$$\alpha = K\lambda_0^{-1/2}(2/b + \lambda_0^2/a^3)(\lambda_g/\lambda_0) \ldots . dB/ft.$$

Where: λ_g = operating waveguide wavelength; $\lambda_g = \lambda_0/[1-(\lambda_0/2a)^2]^{1/2}$; K = a constant equal to 6.08×10^{-3} for 1100 Alloy Aluminum with alondined internal walls; λ_0 = operating wavelength in free space equal to c/f_0; b = guide height (inside narrow dimension); a = guide width (inside broad dimension); c = velocity of light; and f_0 = frequency.

WAVEGUIDE
FIXED LENGTH LINES AND TAPPED LINES
FOR X-BAND (8.2 TO 12.4 Gc) FREQUENCIES

Tapped waveguide delay line with several input and output ports, each representing a different equivalent free space length. As many as eight delay values may be selected from a single tapped line. These values may be obtained simultaneously



Spiral-Wound waveguide coils.

Fixed length waveguide delay line with one input and one output port. It provides a delay value in accordance with its equivalent free space length. Units are available in lengths from 0.02 to 1.5 microseconds.

MECHANICAL PROPERTIES & FEATURES

Micro-Coax Delay Lines are compact and rugged, yet light in weight. They are constructed of thin wall aluminum tubing, supported by an alloy casting.

All internal flanges are leakage sealed to prevent moisture condensation and reduce stray radiation.

Input and output ports are positioned for easy accessibility in connecting lines to auxiliary equipment.

ELECTRICAL PROPERTIES & FEATURES

Tests show that Micro-Coax Delay Lines have low SWR input values. Advanced swept frequency equipment and techniques are employed to measure the SWR vs. frequency performance of all Micro-Coax lines. Great care is exercised to insure that the measurement includes all the fluctuations (or "fine structure") that are typical in delay lines. All Micro-Coax Delay Lines are supplied with bilateral full bandwidth input SWR test data as described

There are no moving parts, no electrically controlled switches to fail; performance is consistently dependable.

TYPICAL APPLICATIONS

Microwave delay lines have many uses in military electronic systems and countermeasure devices: as test vehicles for radar type equipment and in space simulation experiments. They provide a microwave memory faculty, as a building block in the design of logic circuits. They are valuable in pulse and FM modulation studies and for microwave phase comparison.

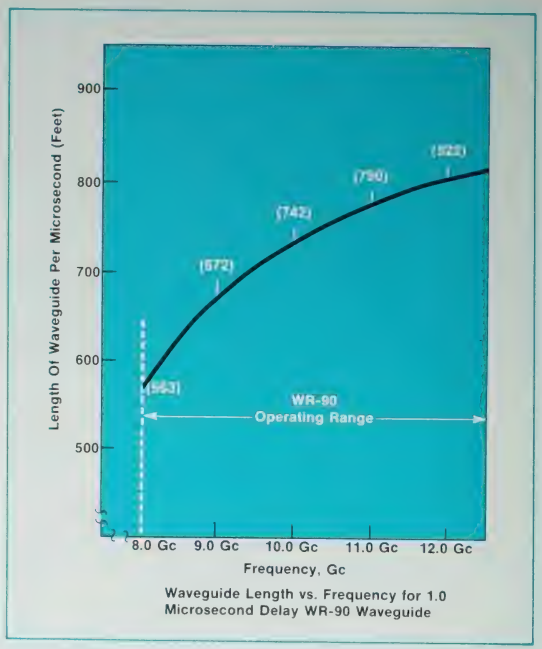
TIME AND DISTANCE

Microwave delay lines, in effect, package free space — that is, they simulate free space environment. In free space, electromagnetic energy travels at a constant velocity, hence distance and time may be expressed interchangeably. In a waveguide medium, the rate of propagation is slower than in free space. Regardless of their ultimate use, all delay lines provide a certain time delay and specific free space equivalent distance. Either of these two factors can be used to determine the length of waveguide tubing required.

To compute the length of line necessary to provide a *delay* at a given frequency, use the following equation:

$$Lg = 984 \times T \times \lambda_o / \lambda_g$$

■ Lg is length of waveguide in feet. ■ 984 is velocity in feet per microsecond. ■ T is the delay in microseconds. ■ λ_o and λ_g are respectively the free space and waveguide wavelength at the given frequency.



Waveguide Length vs. Frequency for 1.0 Microsecond Delay WR-90 Waveguide

To compute the length of line necessary to provide a given *free space distance* at a given frequency, use the following equation:

$$Lg = Lo \times \lambda_o / \lambda_g$$

■ Lg is the length of waveguide in feet. ■ Lo is the given free space distance.

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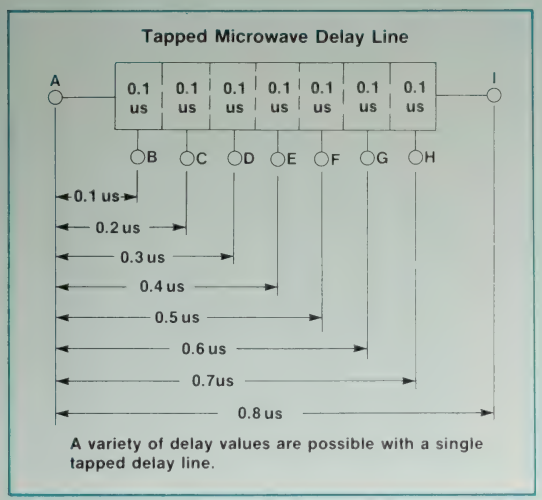
DETERMINING THE MOST SUITABLE TYPE OF LINE

When a single delay value satisfies the requirement, a *Fixed* length microwave delay should be used. When a variety of delay values is necessary a *Tapped* line should be employed. Up to 8 values can be obtained — simultaneously — in a single tapped line. Tapped lines also can be cascaded with fixed lines to form a combination unit of high but variable delay.



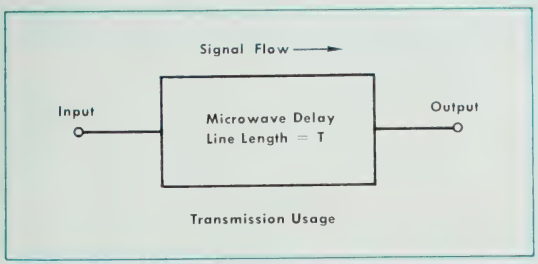
A variety of delay values are possible with a single tapped delay line.

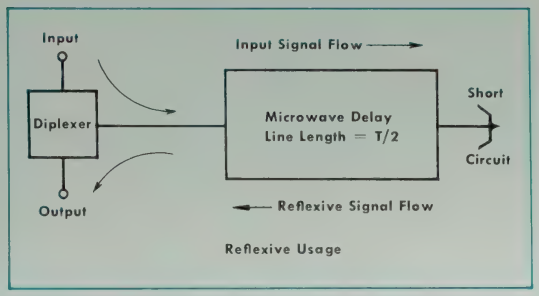
Another type of delay line — the Multilength Variable Delay Line — has a single input port and a single output port, but provides a combination of delays by means of waveguide switches. This type is discussed on pages 68 and 69.

TRANSMISSION vs. REFLEXIVE SYSTEMS

In a transmission system, the signal passes through the line in one direction, from input to output, receiving the nominal delay of the line. In a reflexive system, the second port is short circuited, the signal passes from input to short and returns to the input, where the reflected signal is separated from the input signal by a diplexer. The total reflexive delay equals twice the transmission delay of the unit. See illustration.

Because of intermediate reflection problems in reflexive usage, a transmission system should be employed where space permits. All Micro-Coax Delay Lines are suitable for transmission or reflexive usage.





PROPERTIES OF X-BAND MICRO-COAX DELAY LINES

ATTENUATION OR INSERTION LOSS

The calculated attenuation properties of X-Band Micro-Coax Delay Lines when expressed in dB per microsecond are essentially constant between 8.2 and 12.4 Gc. The aluminum waveguide used in this series yields the lowest attenuation in dB per microsecond of any standard or semi-standard delay line currently available. A computational value of 40 dB per microsecond is recommended for estimating this loss, though the actual value will be slightly less. To compute the estimated attenuation in dB—

When delay time is known: multiply delay time (in microseconds) by 40. For example, when the delay line has a known 0.47 microsecond delay:

$$40 \times 0.47 = 18.8 \text{ dB, maximum}$$

When free space equivalent distance is known: divide free space distance (in feet) by 984 and multiply this by 40 times $\lambda o/\lambda g$. For example, the attenuation incurred by simulating 500 feet of free space at 10.0 Gc ($\lambda o/\lambda g = 0.7550$)

$$500 \times \frac{1}{984} \times 40 \times 0.7550 = 15.3 \text{ dB}$$

Micro-Coax engineers can reduce attenuation by 50% or more where 40 dB per microsecond is intolerably high. For further information, write Micro-Coax Components, Inc., outlining the specific nature of your problem.

All Micro-Coax lines are supplied with individual full bandwidth swept frequency insertion loss test data.

INPUT SWR vs. FREQUENCY

The standing wave ratio (SWR) characteristic of delay lines is a relatively complex function as is its measurement. Briefly, the physically large separation and low line loss between the small reflections that are typical of delay lines tend to produce a rapid fluctuation in the magnitude of the SWR as frequency is varied. The extent of this "fine structure" cannot be measured without advanced swept frequency equipment and techniques in which factors such as sweep rate and equipment response time are carefully controlled and monitored. Micro-Coax Components tests all lines to insure that the upper limits of the "fine structure" will not exceed the specification values for input SWR.

All Micro-Coax Components Delay Lines are supplied with bilateral full bandwidth swept frequency input SWR test data indicating the highest value of fine structure SWR.

MICROWAVE DELAY LINES

INTERNAL REFLECTIONS

Micro-Coax Delay Lines are constructed from low loss modular sub-elements. Rigid sub-assembly SWR tests — to acceptance standards an order of magnitude stricter than assembly specifications — are performed on each sub-assembly during manufacture. These tests insure that each element of a Micro-Coax Delay Line minimizes the extent of hidden internal reflection. Sub-element test data can be supplied for any Micro-Coax Delay Line upon request.

MULTILENGTH VARIABLE DELAY LINES

Micro-Coax Components also can provide a delay line system with delay time incrementally variable from very low values up to as much as 2.5 microseconds. Each multi-length module consists, essentially, of a fixed length unit with an electrically controlled waveguide switch. A group of modules, when cascaded, provides one input and one output port with the intervening time delay remotely varied by the operator.

Each different multilength module provides a different delay. The smallest module chosen determines both the *minimum* delay time and the step length. The sum of the delays of the several modules chosen determines the *maximum* delay time. The modules are designed so that successive part numbers, when cascaded, will provide no overlapping steps.

If particular requirements arise, consult your Micro-Coax Components Sales Engineer.

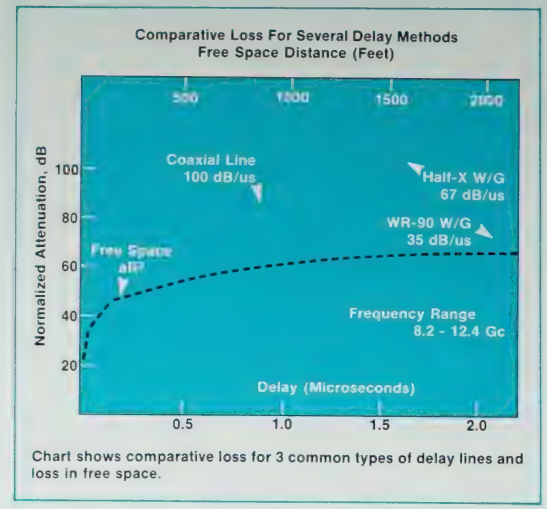


Chart shows comparative loss for 3 common types of delay lines and loss in free space.

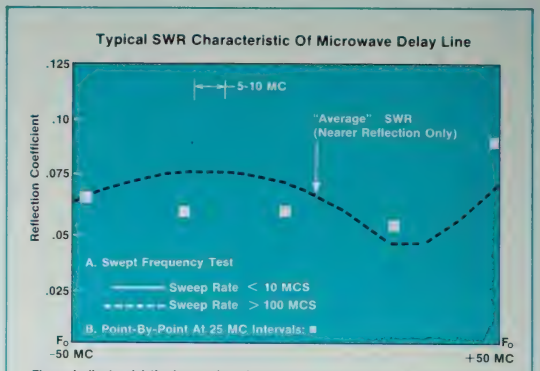
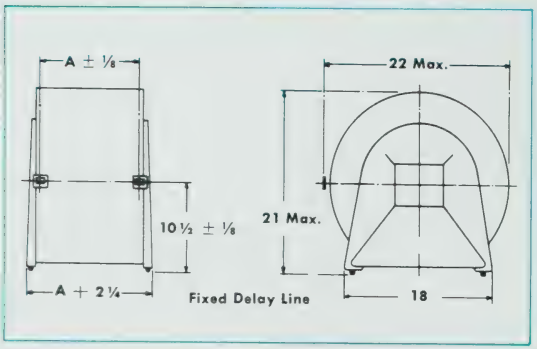
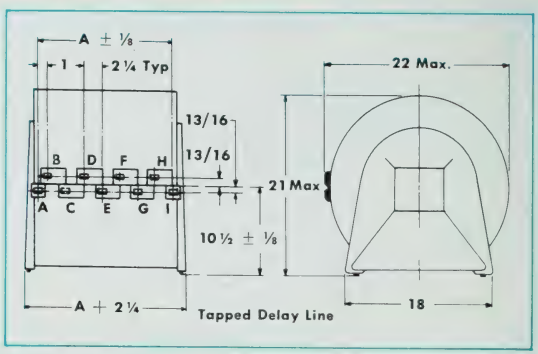


Figure indicates (a) the incomplete data one might obtain with a point-by-point measurement at intervals of 25 mc; (b) the average value which poor response time or high sweep rate will indicate; and (c) the nearly periodic fine structure which presents the actual reflection properties of the line.

TECHNICAL DATA ON MICROWAVE DELAY LINES





TECHNICAL SPECIFICATIONS ON MICROWAVE DELAY LINES

FIXED DELAY LINES

MCC Part Number	Waveguide Length (ft/m)	Delay (microseconds) 8.0 Gc	9.0 Gc	10.0 Gc	11.0 Gc	12.0 Gc	Dim "A" Output Spacing (in/mm)	Weight Max. (lbs/kg)
9003	115.5/35.2	0.21	0.17	0.16	0.15	0.14	2.9/73.7	29/13.15
9004	159.0/48.5	0.28	0.24	0.22	0.20	0.19	2.9/73.7	34/15.42
9005	195.2/59.5	0.35	0.29	0.26	0.25	0.24	4.9/124	41/18.60
9006	238.7/72.8	0.42	0.35	0.32	0.30	0.29	4.9/124	47/21.32
9007	274.8/83.3	0.49	0.41	0.37	0.35	0.33	6.9/175	53/21.04
9008	318.3/97.0	0.57	0.47	0.43	0.40	0.39	6.9/175	59/26.76
9009	354.5/108	0.63	0.53	0.48	0.45	0.43	8.9/226	65/29.48
9010	398.0/121	0.71	0.59	0.54	0.50	0.48	8.9/226	71/32.21
9011	434.1/132	0.76	0.64	0.59	0.55	0.53	10.8/274	77/34.93
9012	477.6/146	0.85	0.71	0.65	0.60	0.58	10.8/274	83/37.65
9013	513.2/156	0.91	0.76	0.70	0.65	0.63	12.8/325	89/40.37
9014	557.3/170	0.99	0.83	0.75	0.70	0.68	12.8/325	95/43.09
9015	593.5/181	1.05	0.88	0.80	0.75	0.72	14.7/373	101/45.81
9016	640.0/195	1.14	0.95	0.87	0.81	0.78	14.7/373	107/48.54
9017	673.1/205	1.20	1.00	0.91	0.85	0.82	16.7/424	113/51.26
9018	716.6/218	1.27	1.06	0.97	0.91	0.87	16.7/424	119/53.98
9019	752.8/229	1.34	1.12	1.02	0.95	0.91	18.7/475	125/56.7
9020	796.3/243	1.41	1.18	1.07	1.00	0.97	18.7/475	131/59.42
9021	832.4/254	1.47	1.23	1.12	1.05	1.02	20.6/523	137/62.14
9022	875.9/267	1.56	1.30	1.18	1.11	1.06	20.6/523	143/64.86
9023	912.1/278	1.62	1.35	1.23	1.15	1.11	22.6/574	149/67.59
9024	955.6/291	1.70	1.41	1.29	1.21	1.16	22.6/574	155/70.30
9025	991.8/302	1.76	1.47	1.34	1.25	1.20	24.5/622	161/73.03

Note — Input SWR 1.25:1 maximum
Tolerance of all tabulated waveguide lengths ± 2%.

TAPPED DELAY LINES

Model 6706-A:01—0.35 Microsecond—3 Taps					
Tap Number	Waveguide Length (ft/m)	Delay (microseconds) 8.5 Gc	9.0 Gc	9.5 Gc	10.0 Gc
B	79.3/24.2	0.13	0.12	0.11	0.105
C	159.0/48.5	0.25	0.24	0.23	0.22
D	238.7/72.8	0.37	0.35	0.33	0.32
Weight: 50 lbs. Overall dimensions: 21" H x 8" W x 21" D					

Model 6710-A:0.1—0.6 Microsecond—5 Taps					
Tap Number	Waveguide Length (ft/m)	Delay (microseconds) 8.5 Gc	9.0 Gc	9.5 Gc	10.0 Gc
B	79.3/24.2	0.13	0.12	0.11	0.105
C	159.0/48.5	0.25	0.24	0.23	0.22
D	238.7/72.8	0.37	0.35	0.33	0.32
E	318.3/97.0	0.50	0.47	0.44	0.43
F	398.0/121	0.62	0.59	0.55	0.54
Weight: 75 lbs. Overall dimensions: 21" H x 12" W x 21" D					

Model 6716-A:0.1—0.9 Microsecond—8 Taps					
Tap Number	Waveguide Length (ft/m)	Delay (microseconds) 8.5 Gc	9.0 Gc	9.5 Gc	10.0 Gc
B	79.3/24.2	0.13	0.12	0.11	0.105
C	159.0/48.5	0.25	0.24	0.23	0.22
D	238.7/72.8	0.37	0.35	0.33	0.32
E	318.3/97.0	0.50	0.47	0.44	0.43
F	398.0/121	0.62	0.59	0.55	0.54
G	477.6/146	0.75	0.71	0.66	0.64
H	557.3/170	0.87	0.83	0.77	0.75
I	640.0/195	1.00	0.95	0.89	0.86
Weight: 110 lbs. Overall dimensions: 21" H x 18" W x 21" D					

Note — Input SWR 1.30:1 maximum
Tolerance of all tabulated waveguide lengths is ± 2%.

MULTILENGTH VARIABLE UNITS

Module Number	Waveguide Length (ft/m)	Delay (microseconds) 8.0 Gc	9.0 Gc	10.0 Gc	11.0 Gc	12.0 Gc	Panel Height* (inches/mm)	Weight (lbs/kg)
9501	20/6.10	0.035	0.03	0.027	0.025	0.024	5/127	20/9.072
9502	42/12.8	0.075	0.062	0.057	0.053	0.051	5/127	22/9.979
9503	82/24.9	0.145	0.12	0.11	0.105	0.10	6/152	25/11.34
9504	163/49.7	0.29	0.24	0.22	0.21	0.20	8/203	50/22.68
9505	321/97.8	0.57	0.48	0.43	0.41	0.39	12/305	85/38.55
9506	640/195	1.14	0.96	0.88	0.82	0.79	20/508	165/74.84

**Module dimensions are 22½" wide by 24" deep. Height as above. □ Tolerance of all tabulated waveguide lengths is ± 2%.*
Note — Input SWR 1.50:1 maximum

TECHNICAL SPECIFICATIONS ON SPIRAL DELAY COMPONENTS

SINGLE SPIRAL-FORMED ELEMENTS FOR X-BAND AND OTHER BANDS

For applications requiring short time delays (0.025 to 0.2 microsecond), special assembly packaging by the user, or maximum economy, Micro-Coax Components offers the following spiral-formed waveguide delay line components in several frequency bands.

Components are delivered with complete electrical test and inspection data including swept frequency data of input SWR and Insertion Loss.

Specifications and technical data on fully packaged Fixed Length or Tapped Micro-Coax Delay Lines in these and other waveguide types are also available.

MCC Part Number	Waveguide Type	Frequency Band Gc	Part Name	Length (ft/m)	Midband Delay (us)	Midband Insertion Loss (dB)	Input SWR (max.)
13701	WR 137	5.8-8.2	Delay Line	39/11.88	.05	2.4	1.20:1
137005	WR 137	5.8-8.2	Delay Line	19/5.791	.023	1.4	1.20:1
13751	WR 137	5.8-8.2	Interconnection	0.3/0.091	—	—	1.12:1
11201	WR 112	7-10	Delay Line	38/11.58	.05	2.5	1.20:1
112005	WR 112	7-10	Delay Line	19/5.791	.024	1.4	1.20:1
11251	WR 112	7-10	Interconnection	0.3/0.091	—	—	1.12:1
90005	WR 90	8.2-12.4	Delay Line	39/11.88	.05	2.8	1.15:1
9005	WR 90	8.2-12.4	Delay Line	18/5.486	.023	1.5	1.15:1
9051	WR 90	8.2-12.4	Interconnection	0.3/0.091	—	—	1.08:1
7501	WR 75	10-15	Delay Line	39/11.88	.05	3.0	1.20:1
75005	WR 75	10-15	Delay Line	18/5.486	.023	1.6	1.20:1
7551	WR 75	10-15	Interconnection	0.3/0.091	—	—	1.12:1
6201	WR 62	12-18	Delay Line	39/11.88	.05	4.0	1.20:1
62005	WR 62	12-18	Delay Line	18/5.486	.025	2.2	1.20:1
6251	WR 62	12-18	Interconnection	0.3/0.091	—	—	1.10:1

Note — Order interconnections at rate of one (1) interconnection per delay line.

TOLERANCE OF ALL TABULATED WAVEGUIDE LENGTHS IS ± 2%.

Micro-Coax Components, Inc., Box E, Collegeville, Pa. 19426, U.S.A. □ 215/489-3700

ENGINEERING ASSISTANCE

The engineering staff at Micro-Coax Components is available for technical assistance in the design, utilization, testing, or production of any of the microwave components described in this catalog.

micro-COAX™

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